EXHIBIT F

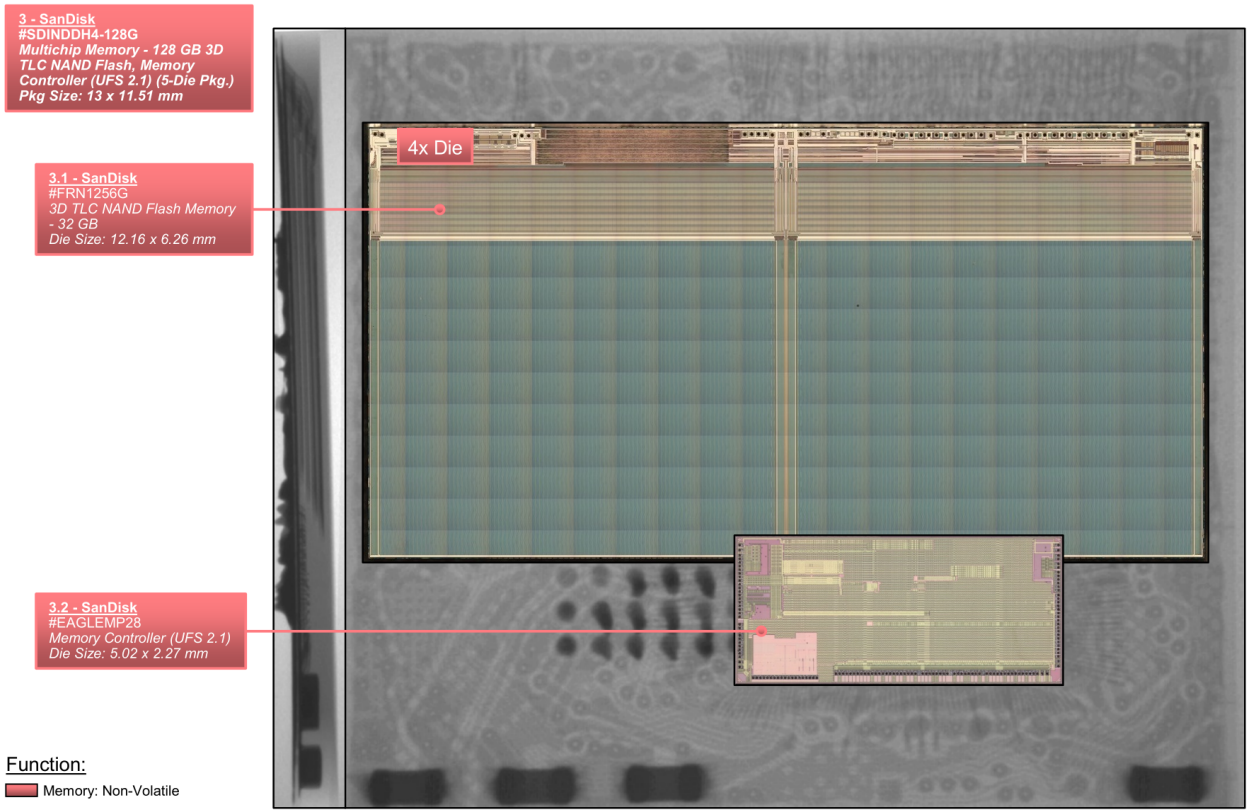
U.S. Patent No. 6,724,241 ("'241 Patent")

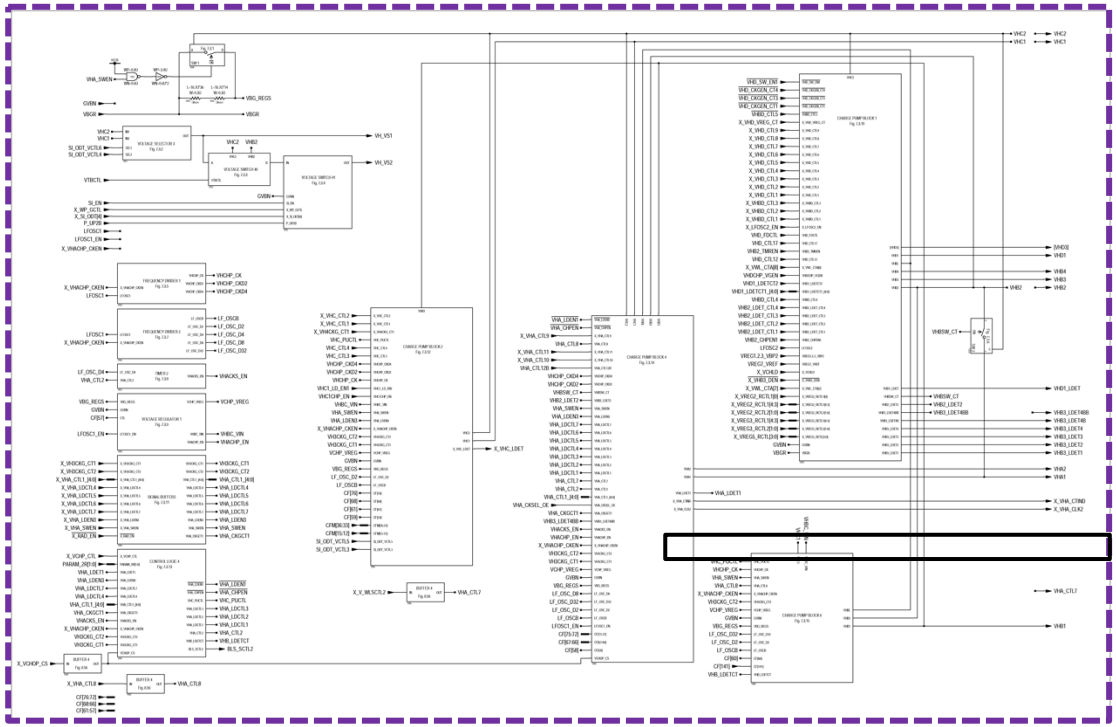
Accused Products

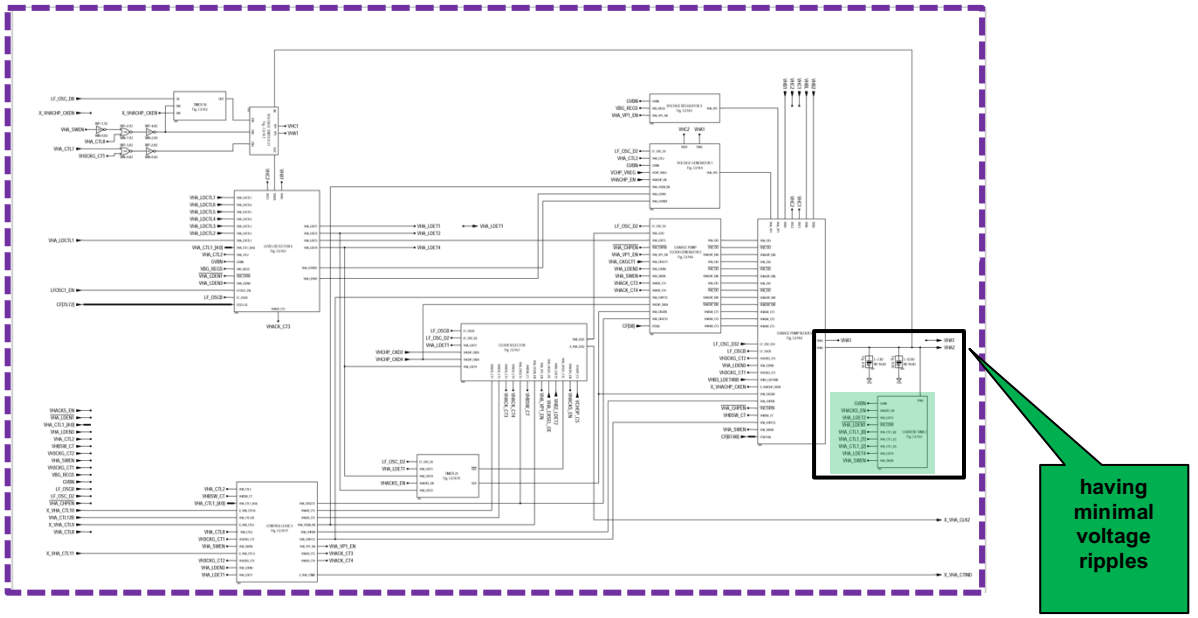
LG products with SanDisk/Toshiba 64L 3D NAND flash chips, including without limitation the LG V50 ThinQ ("Accused Products"), infringe at least Claims 1-3, 6-8, and 11 of the '241 Patent.

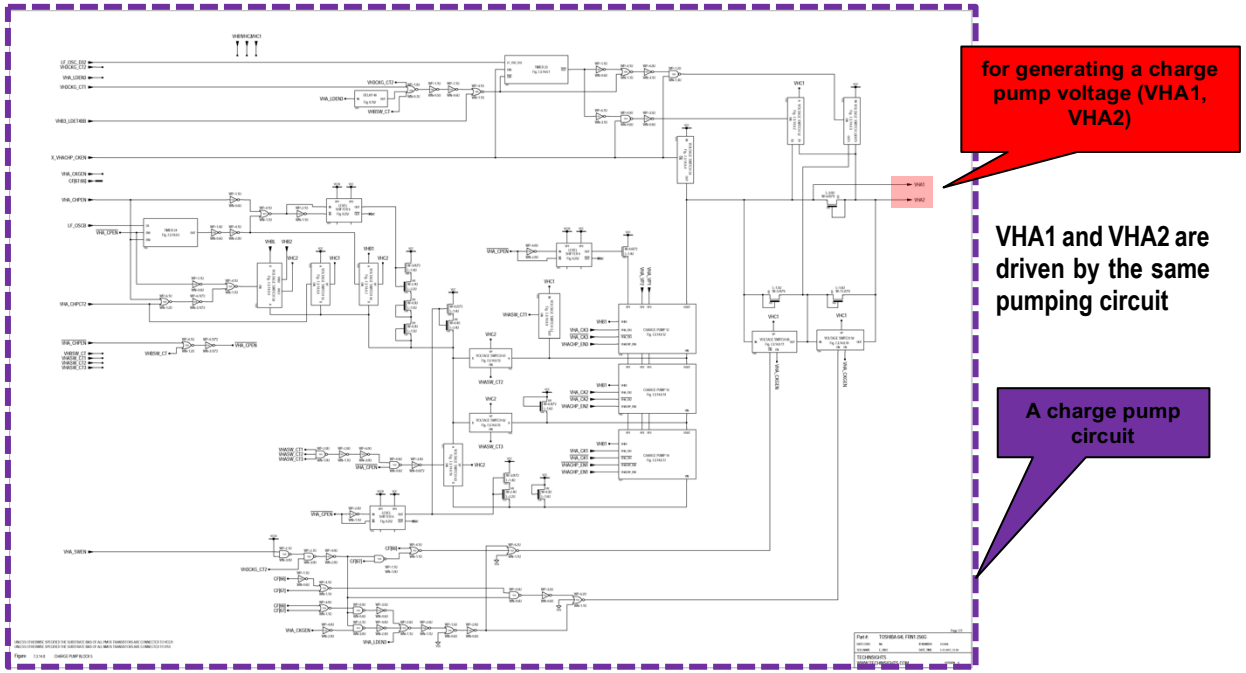
Claim 1

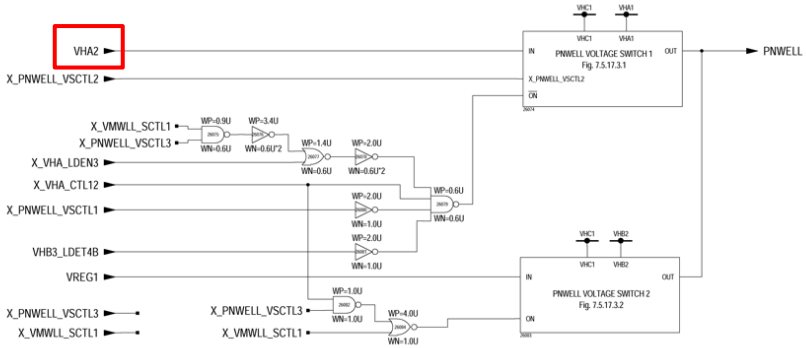
Claim 1	Accused Product
[1pre] 1. A charge pump circuit for generating a charge pump voltage having minimal voltage ripples, comprising:	To the extent the preamble is limiting, each Accused Product includes a charge pump circuit for generating a charge pump voltage having minimal voltage ripples. For example, the V50 ThinQ includes the charge pump circuit of the SanDisk/Toshiba 3D NAND flash chip, die identifier FRN1256G. *See, e.g.*:

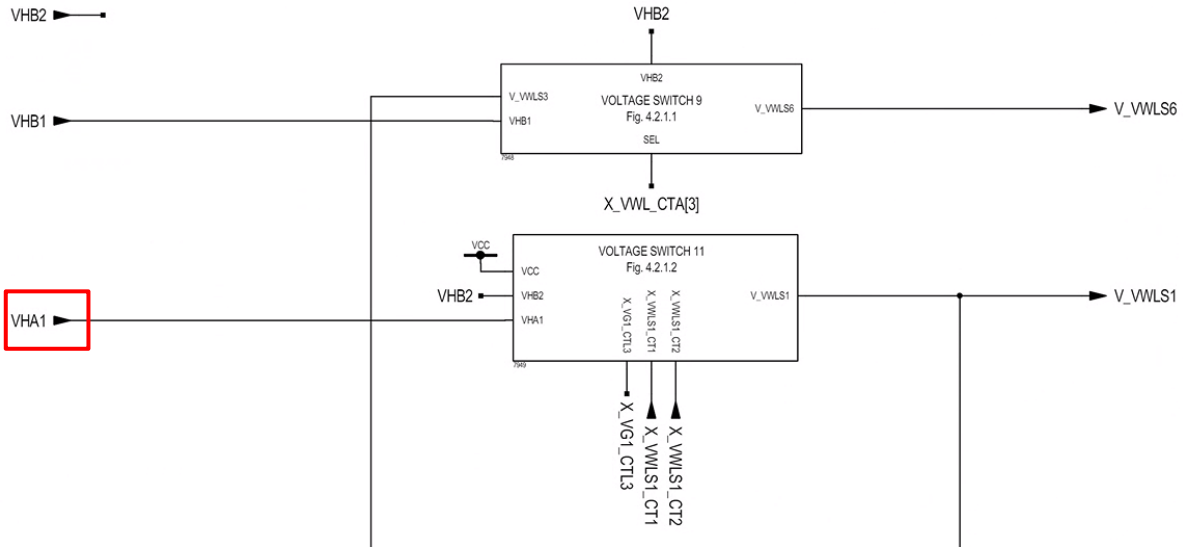
Claim 1	Accused Product
	 Source: TechInsights Deep Dive Teardown, LG V50 ThinQ 5G LM-V450VMB ID355205-DLf

Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3 Charge Pump System

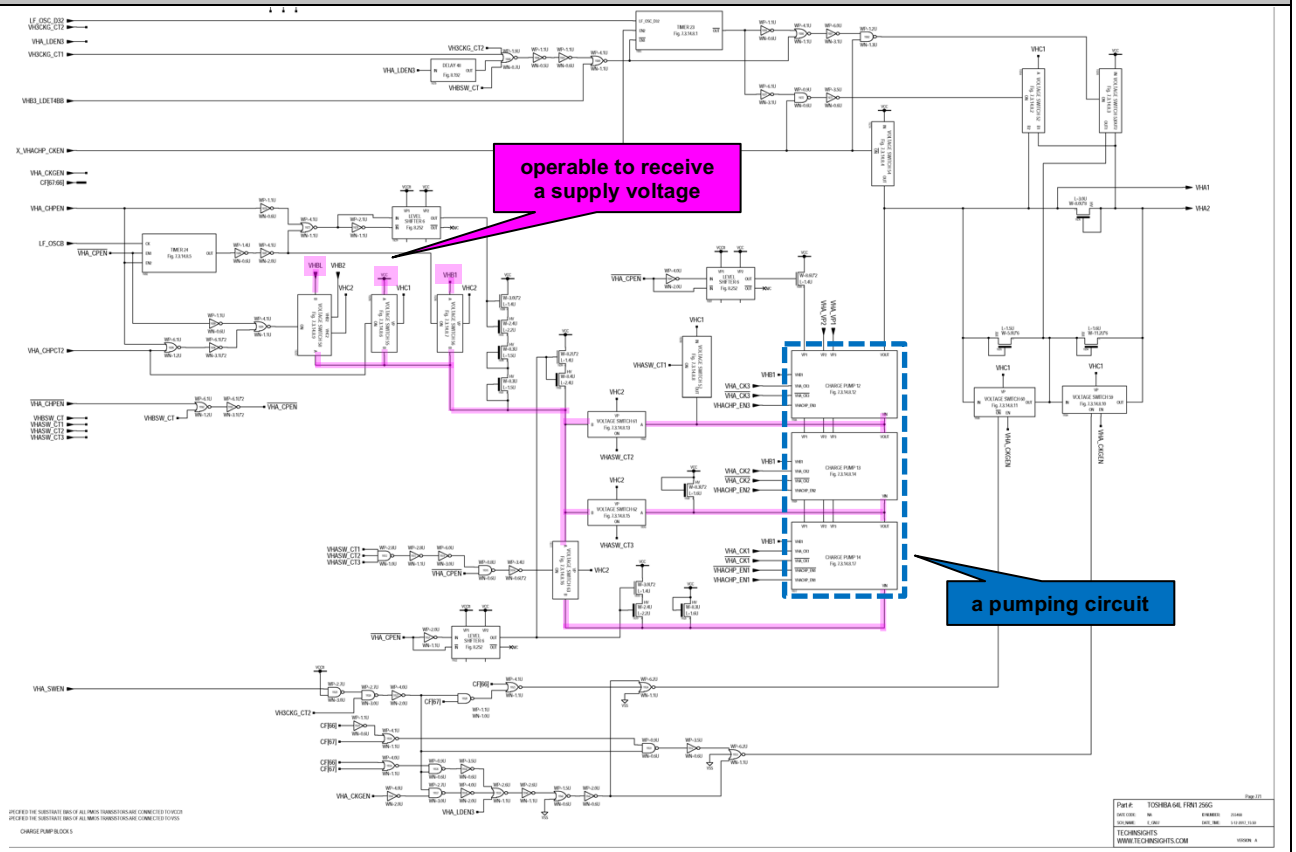
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3 Charge Pump System

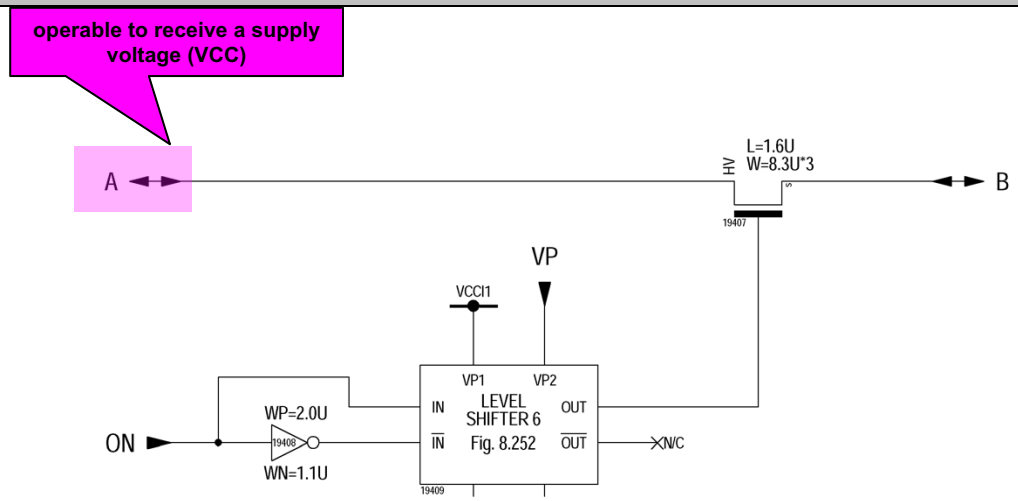
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.8 Charge Pump Block 5

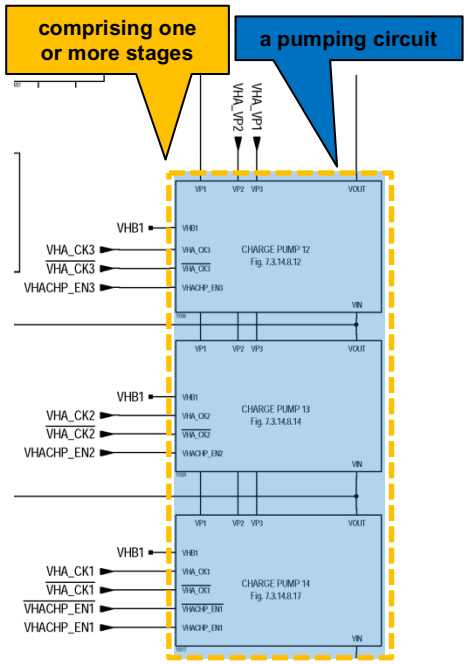
Claim 1	Accused Product
	Charge pump output voltage VHA2 is provided to high voltage switches to selectively drive PNWELL.  Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.5.17.3 PNWELL Voltage Selector

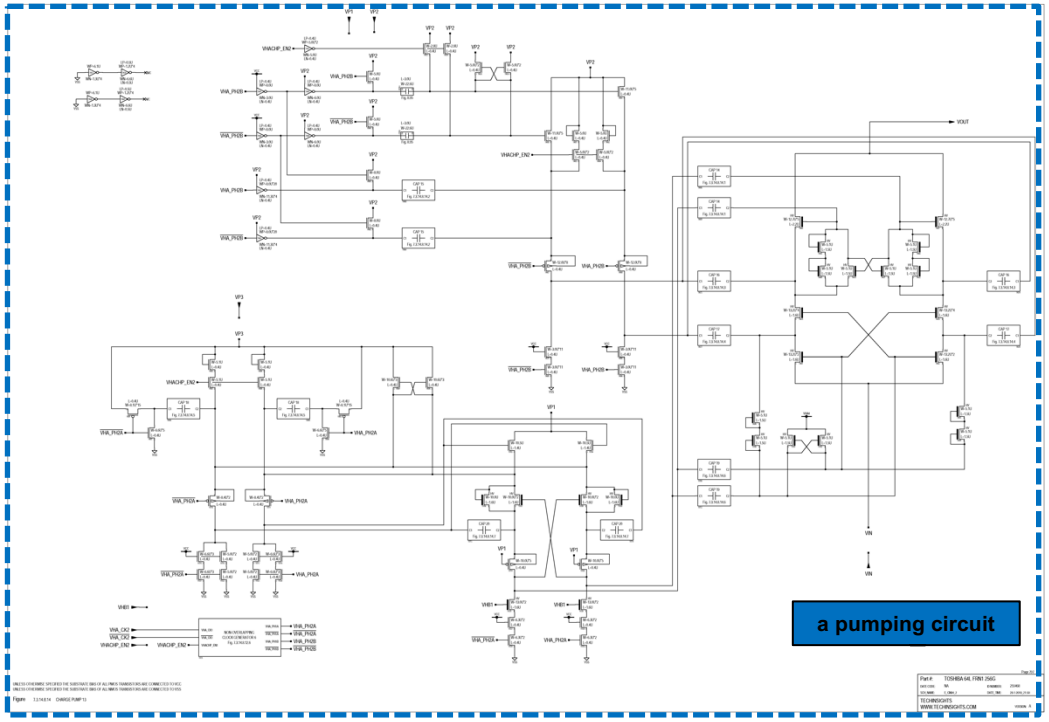
Claim 1	Accused Product
	Charge pump output voltage VHA1 is provided to high voltage switches to selectively drive wordline circuits.  Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 4.2.1 Wordline Voltage Switch Block 1
1[a] a pumping circuit comprising one or more stages operable to receive a supply voltage and generate a selected one of a plurality of pump voltages;	Each Accused Product includes a pumping circuit comprising one or more stages operable to receive a supply voltage and generate a selected one of a plurality of pump voltages. For example, in the pumping circuit, 1, 2, or 3 main stages can be enabled for operation. Supply voltage can be selected from external VCC or internally generated pumped voltages VHBL or VHB1. VHA2 is provided to a level detector which suspends pump clocks when a desired level is reached. VHA2 is scaled by a fixed ratio voltage divider (Voltage Divider 2). It is then compared (using Amplifier 12) to an adjustable reference voltage (generated by Reference Voltage Regulator). A 4-bit digital code CF(75:72) adjusts the output reference voltage by shorting out

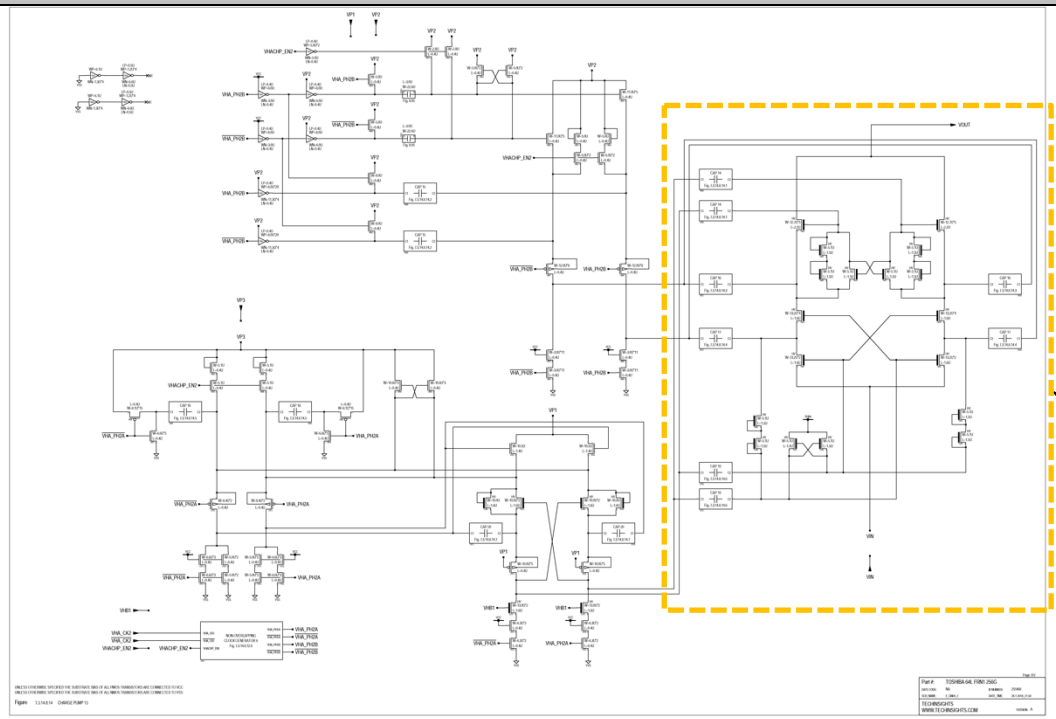
Claim 1	Accused Product
	resistors in a resistor divider, thereby providing programmable pump output voltage levels on VHA1 and VHA2. A comparator (Amplifier 12) compares the scaled VHA2 to the programmable reference voltage. If the scaled VHA2 exceeds the programmable reference voltage, output VHA_LDET3 transitions from 1 to 0 to stop further pumping. VHA_CK2 and VHA_CK2* drive the middle stage of the pumping circuit. VHA_PH2 non-overlapping clocks drive Charge Pump 13. When VHA_PH2 clocks are suspended the pump stops operating so that VHA1 is limited to the voltage set by the level detector. *See, e.g.*:

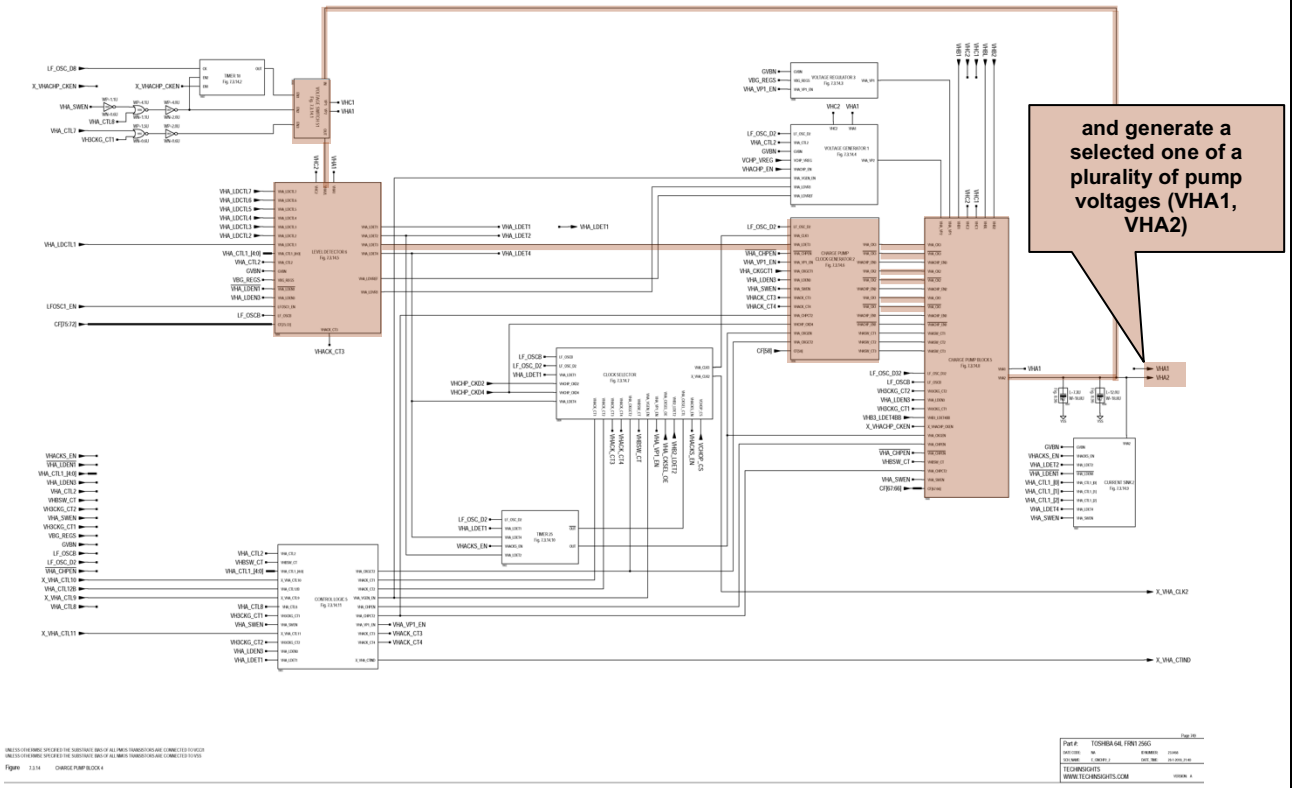
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.8 Charge Pump Block 5

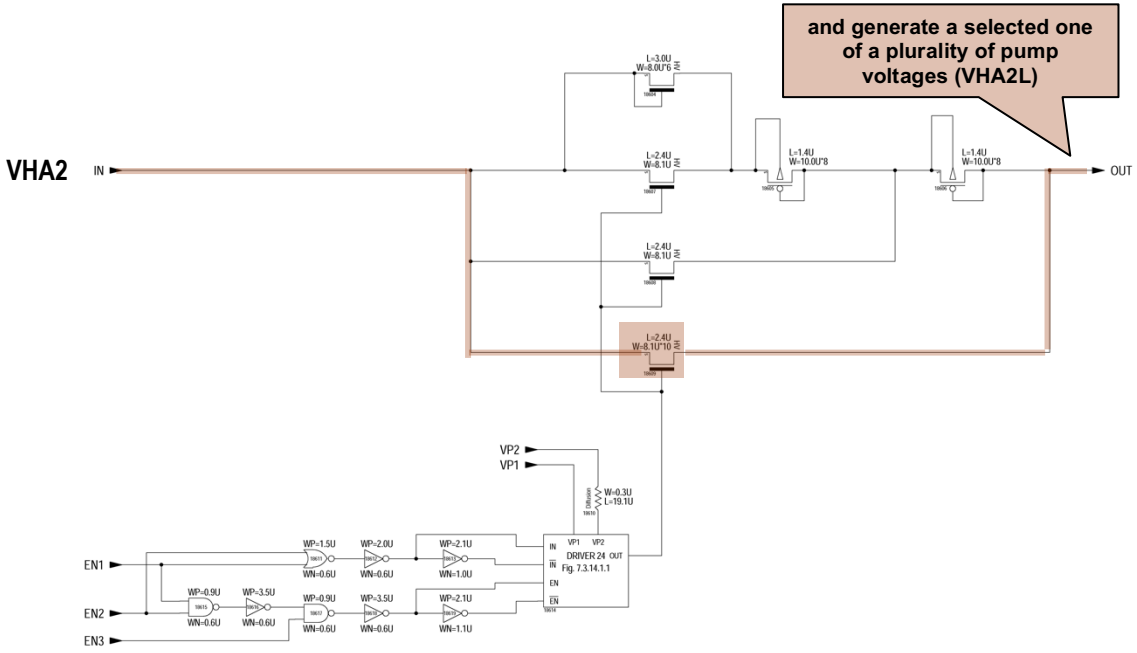
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.8.6 Voltage Switch 55

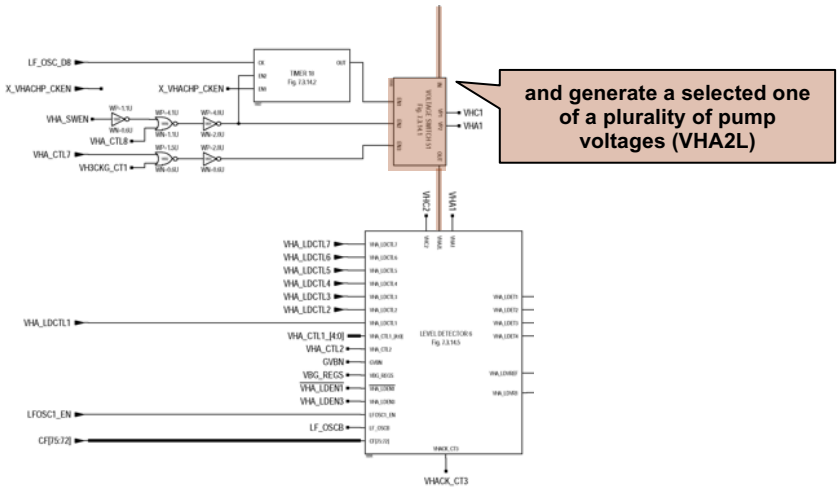
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.8 Charge Pump Block 5

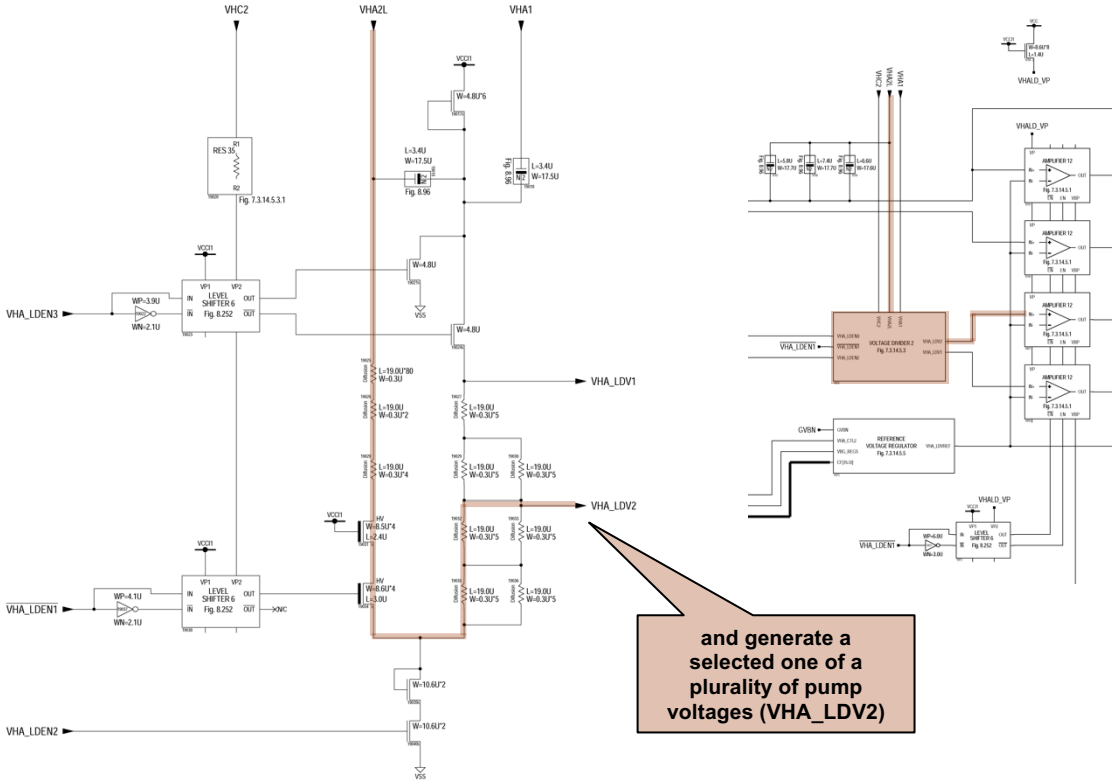
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.8.14 Charge Pump 13

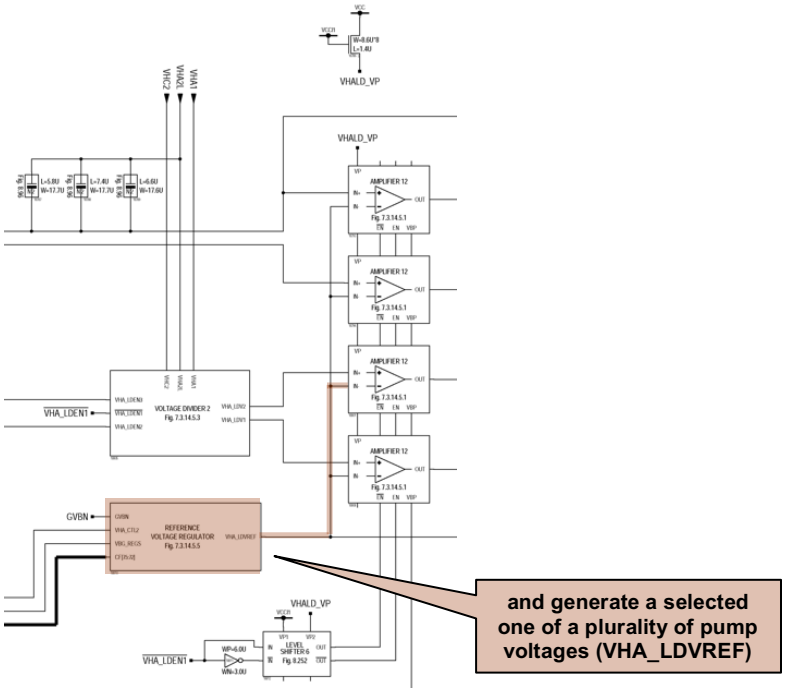
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.8.14 Charge Pump 13

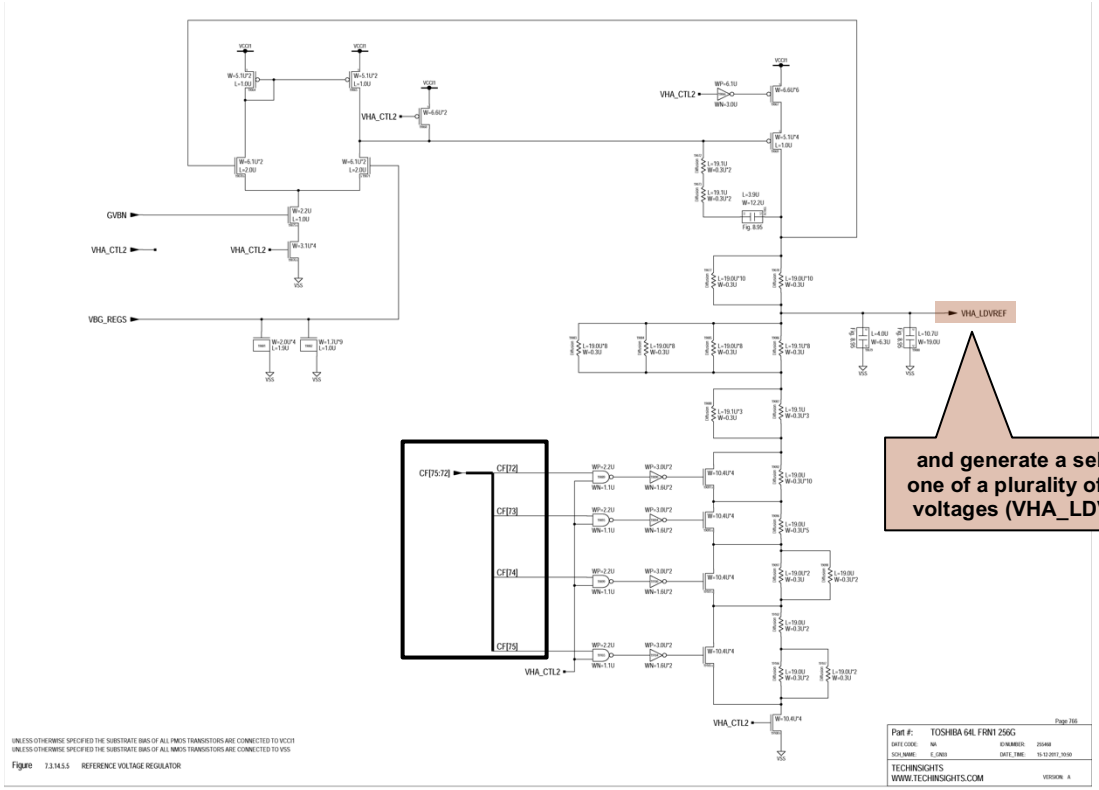
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14 Charge Pump Block 4

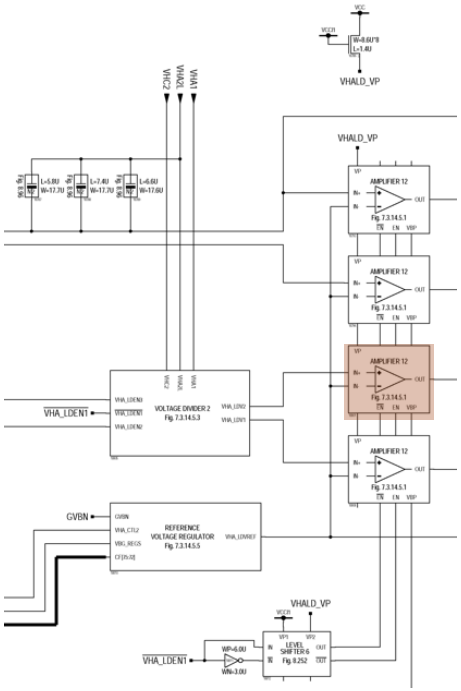
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.1 Voltage Switch 51

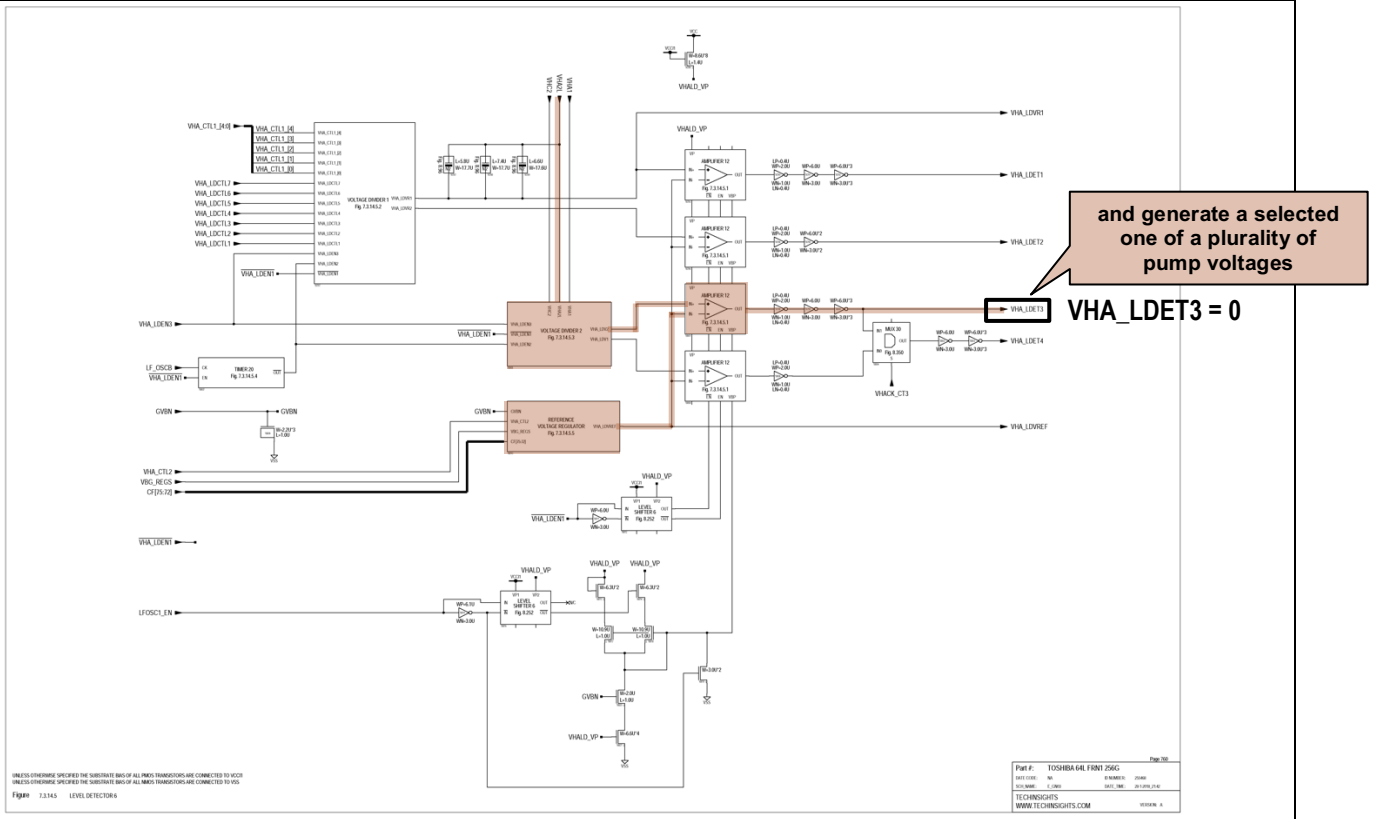
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14 Charge Pump Block 4

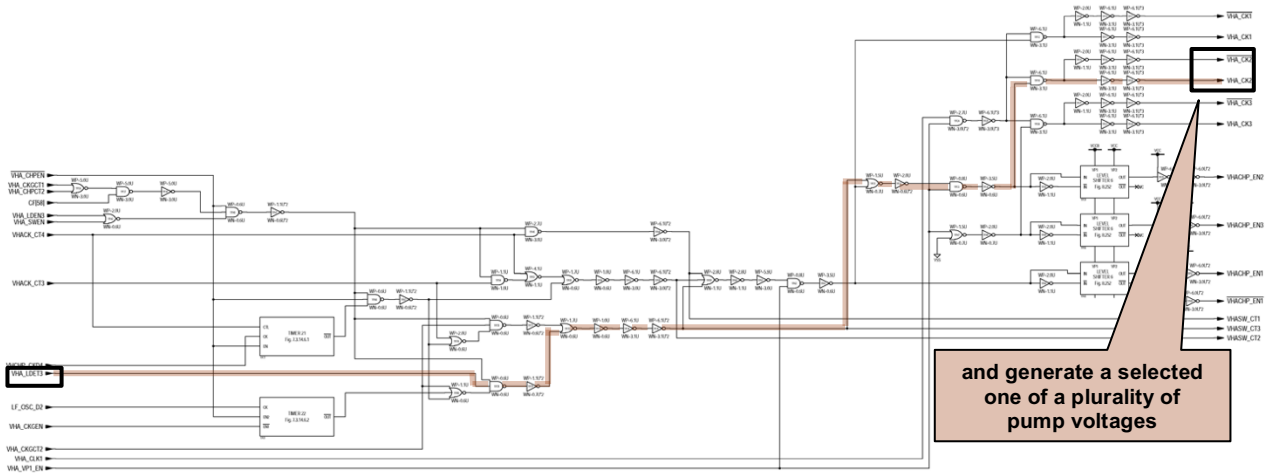
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.5.3 Voltage Divider 2; Figure 7.3.14.5 Level Detector 6

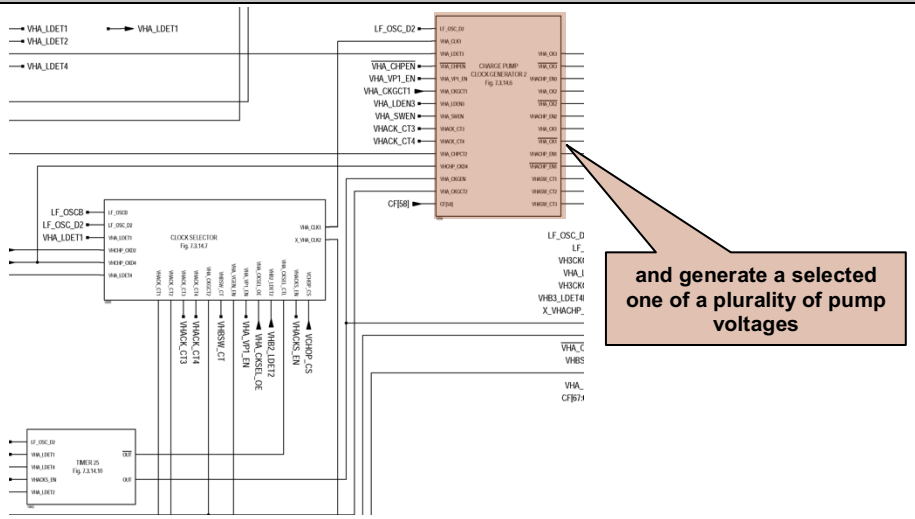
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.5 Level Detector 6

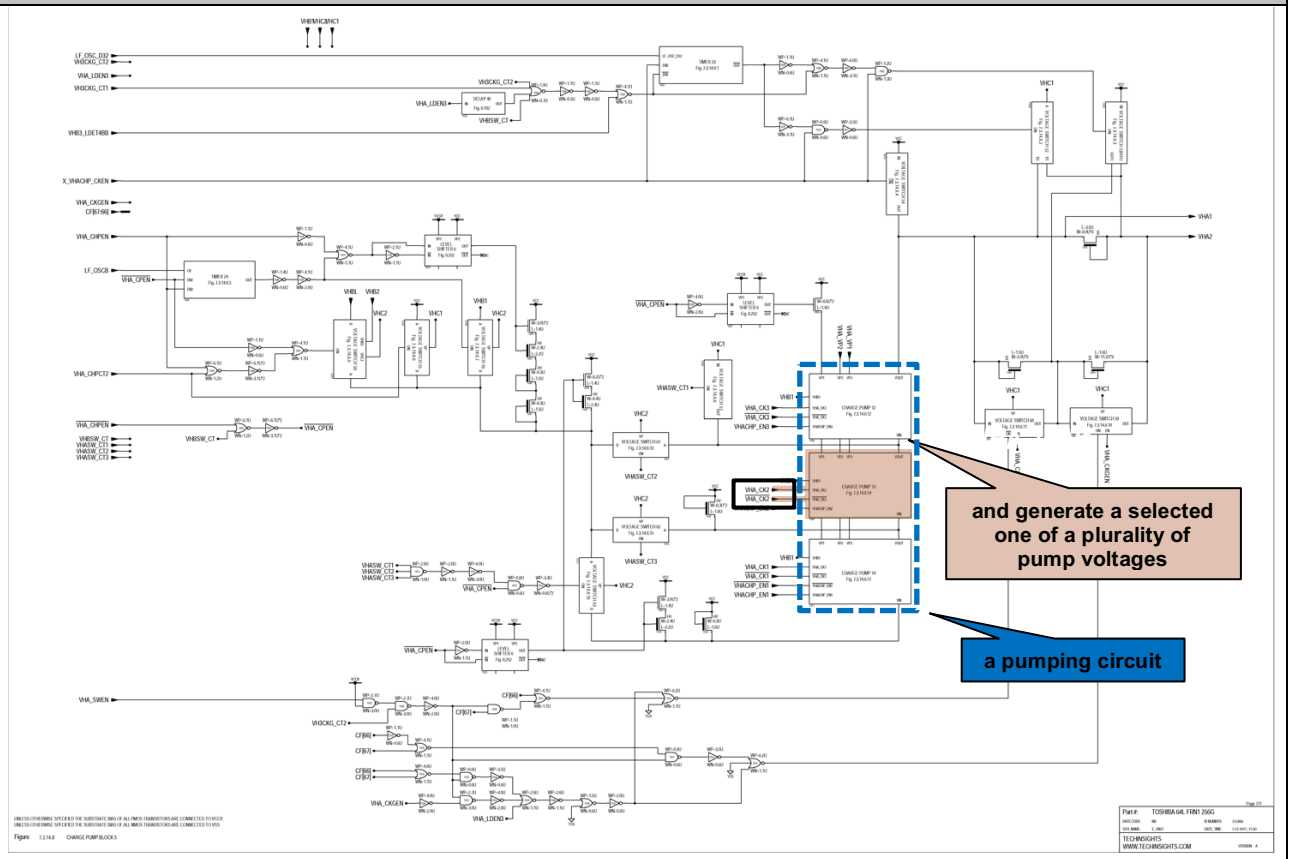
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.5.5 Reference Voltage Regulator

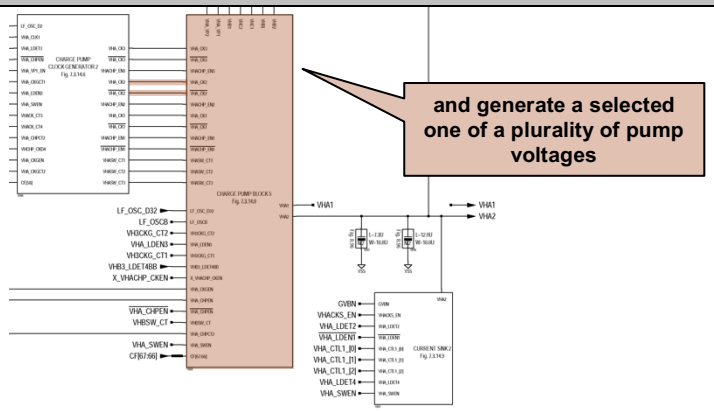
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.5 Level Detector 6

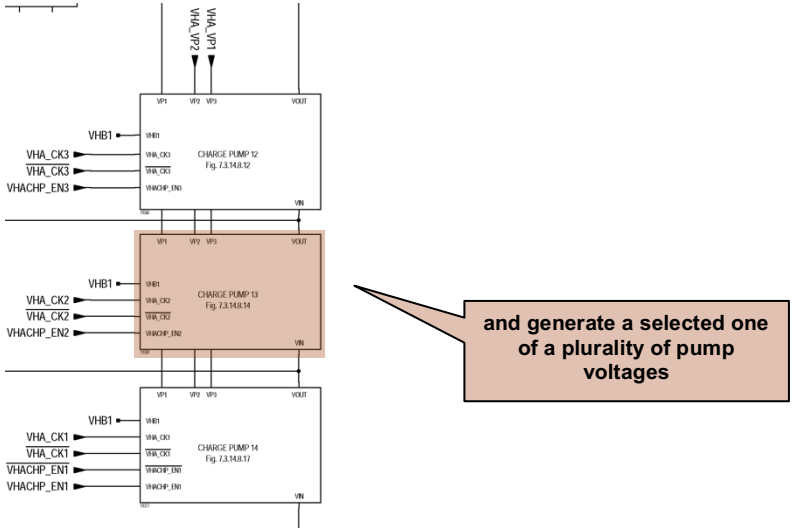
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.5 Level Detector 6

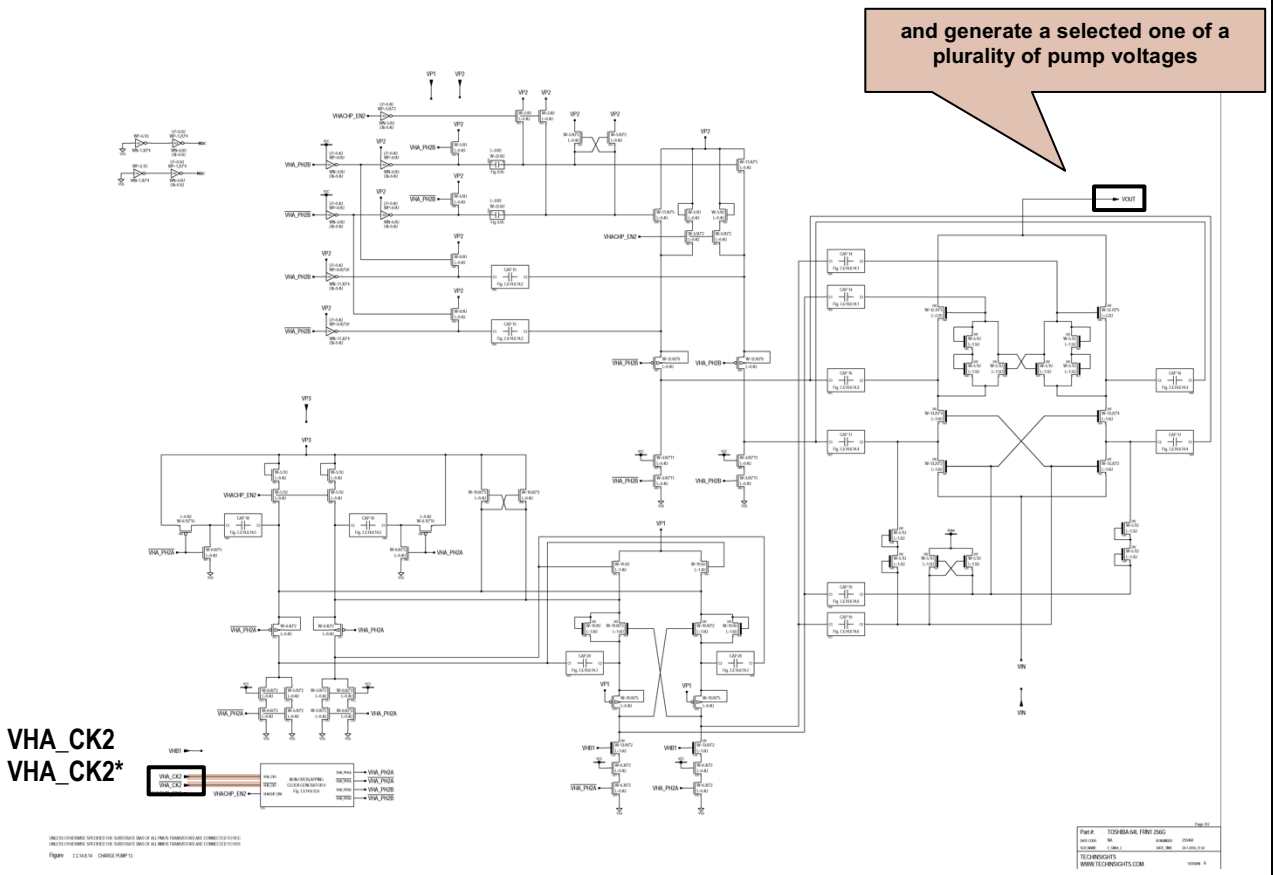
Claim 1	Accused Product
	VHA_LDET3 = 1 **Disables VHA_CK2 pump clock to 1 level** **VHA_CK2 = 1** **VHA_CK2* = 0**  Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.6 Charge Pump Clock Generator 2

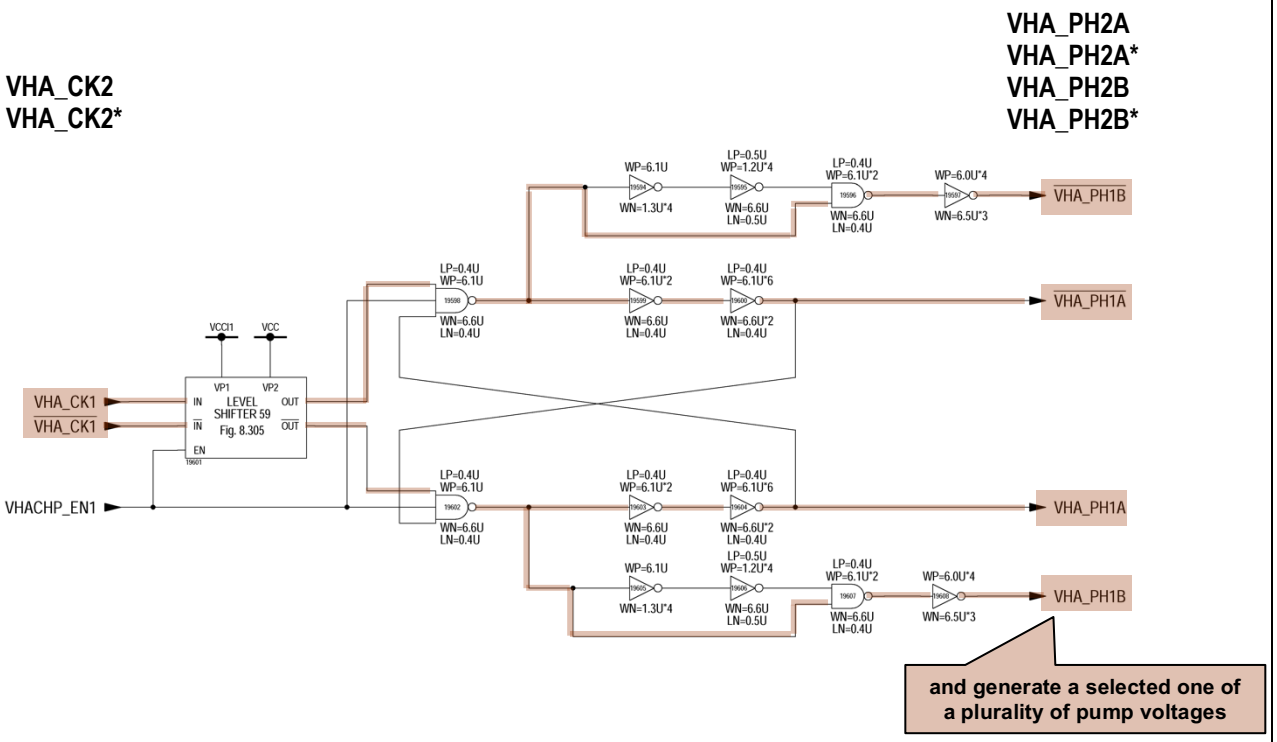
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14 Charge Pump Block 4

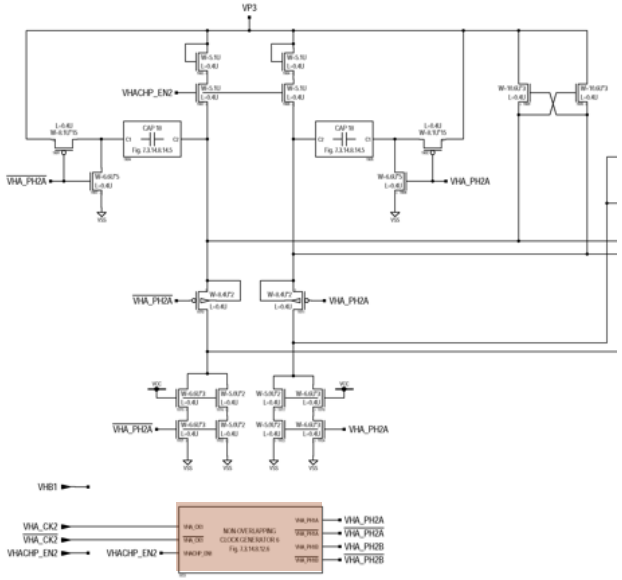
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.8 Charge Pump Block 5

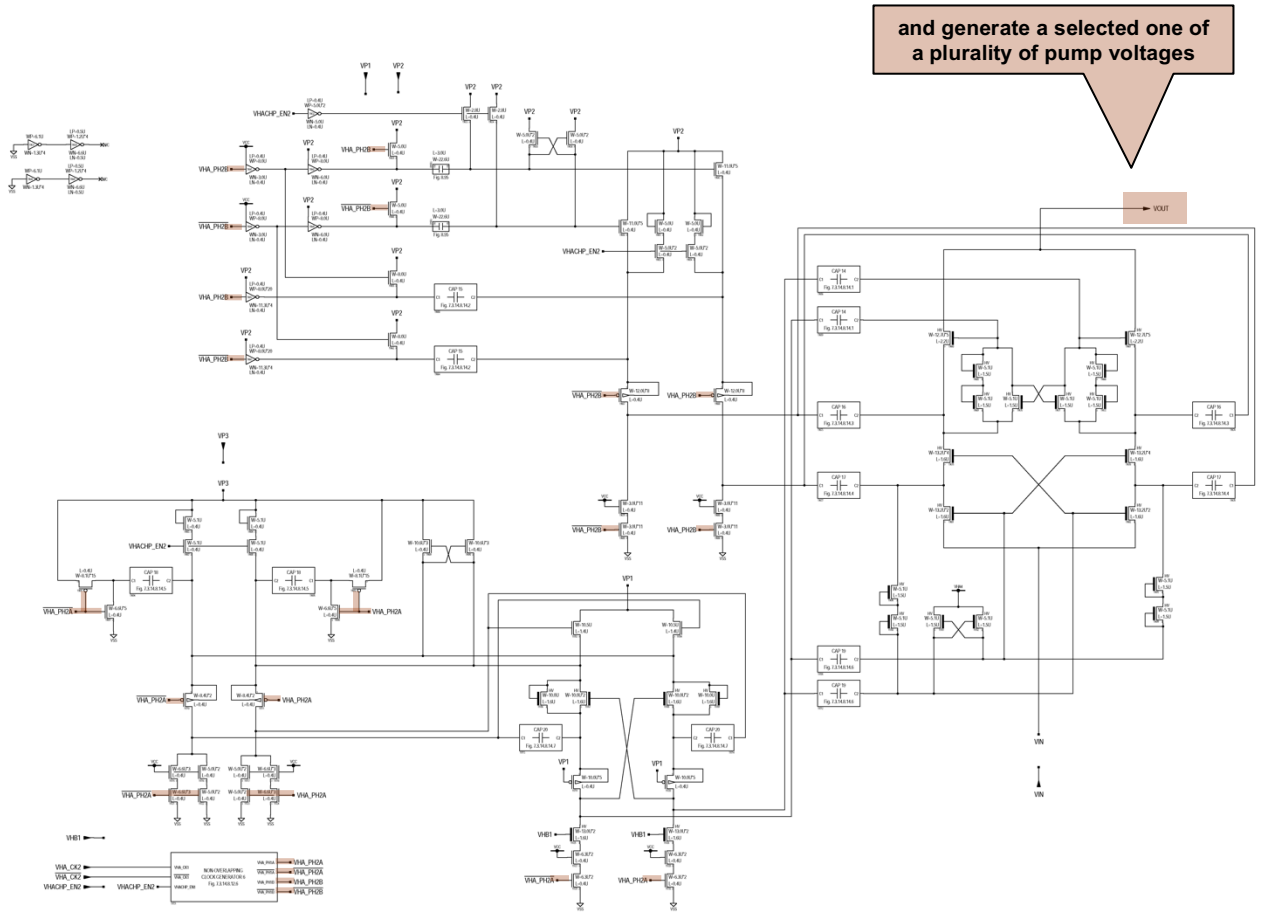
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14 Charge Pump Block 4

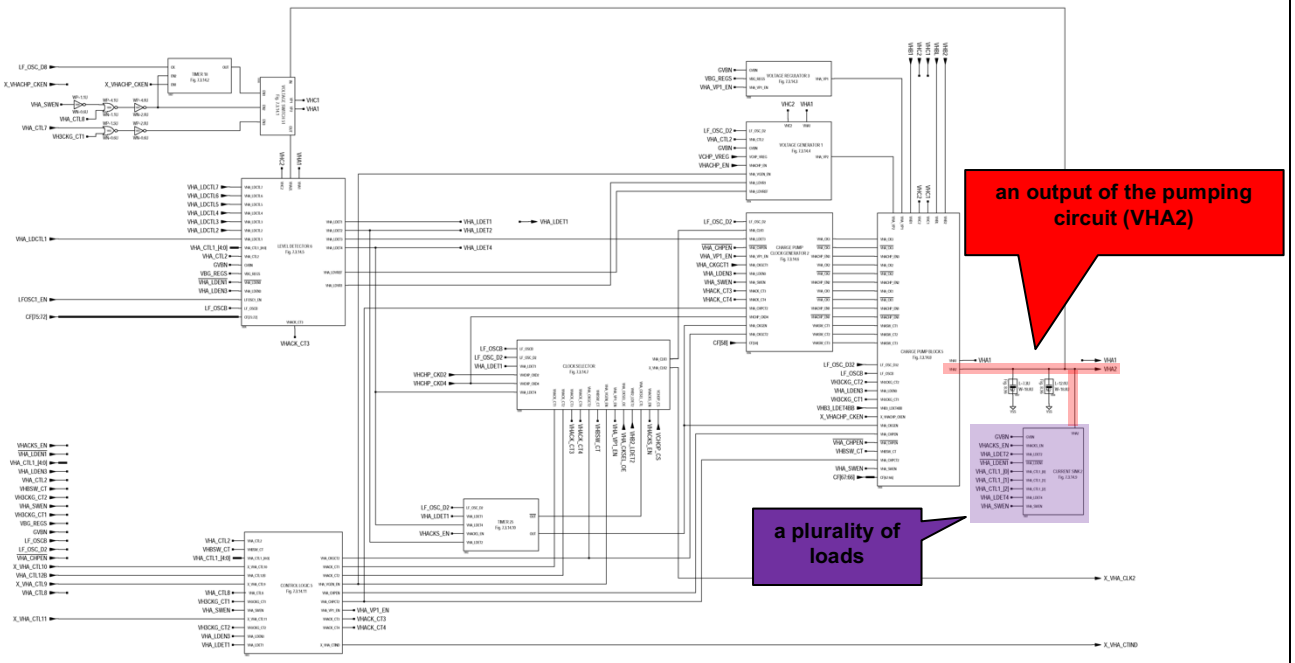
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.8 Charge Pump Block

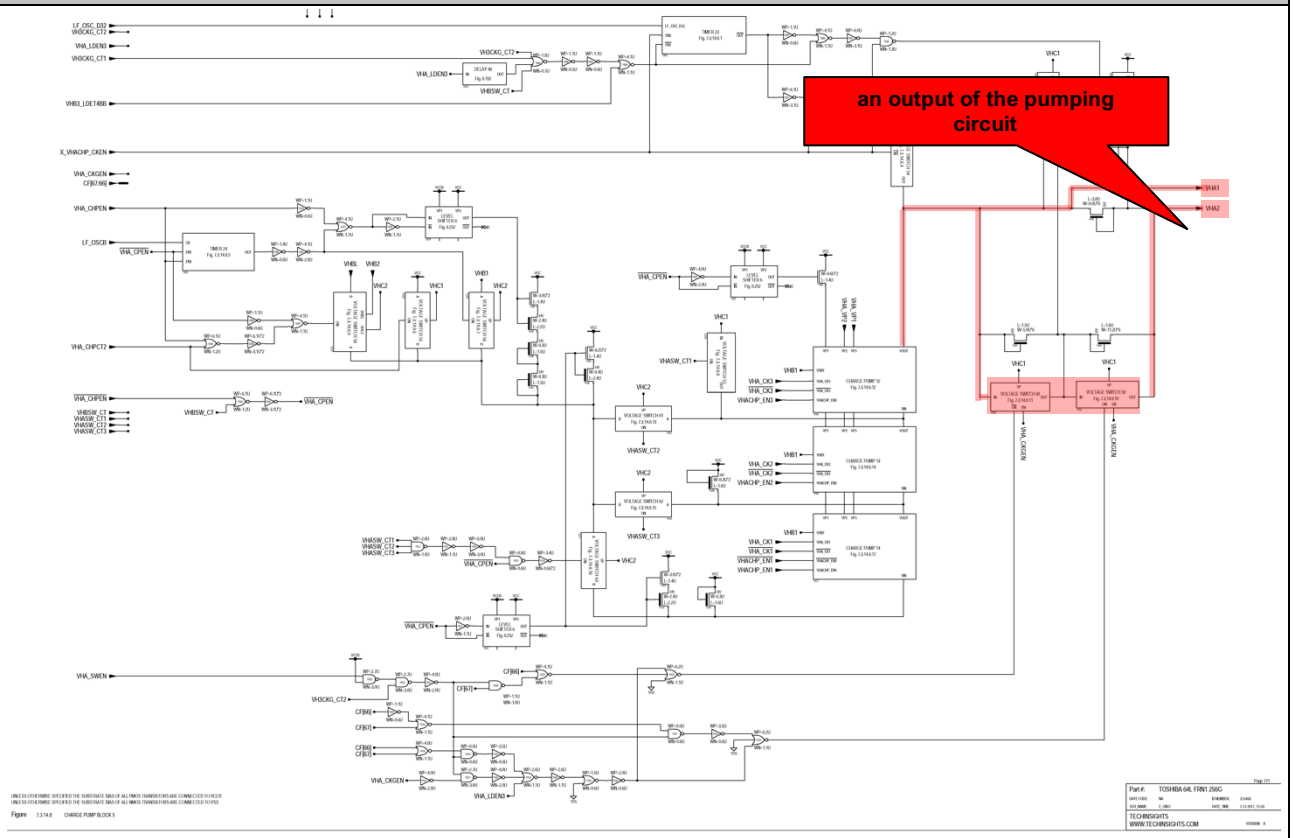
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.8.14 Charge Pump 13

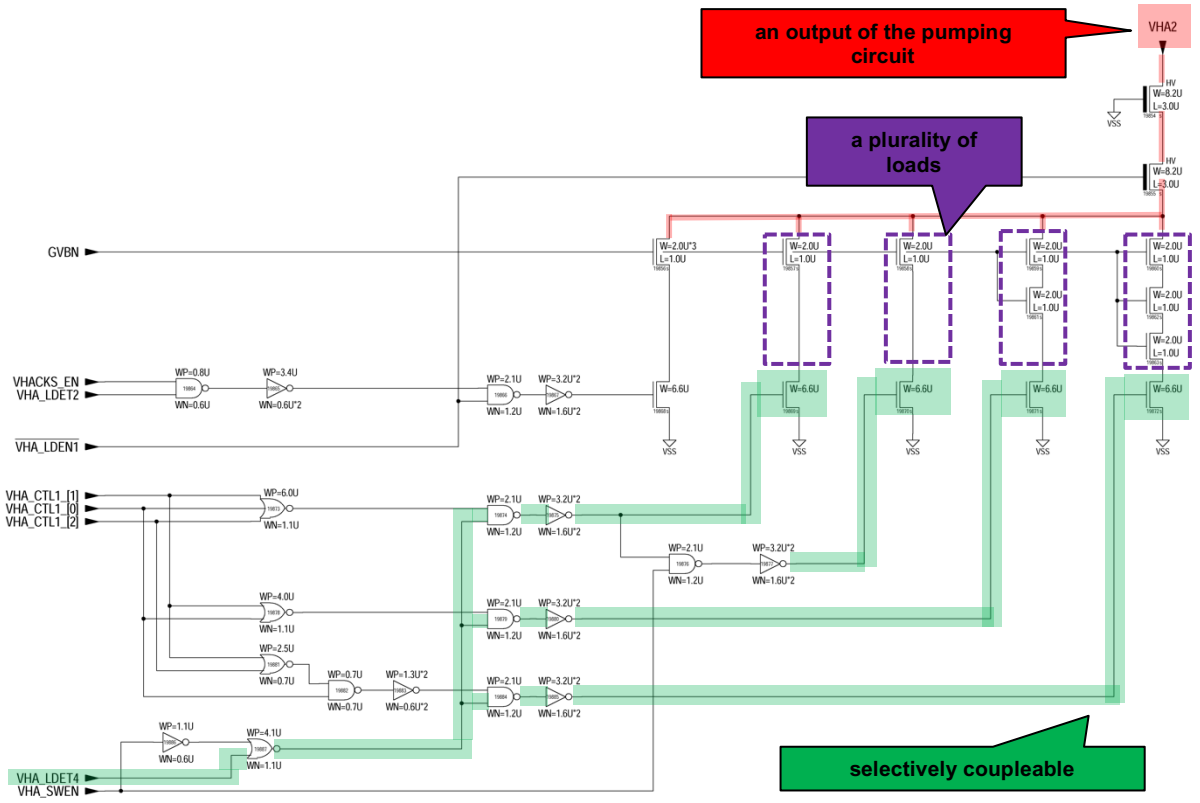
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.8.12.6 Non-Overlapping Clock Generator 6

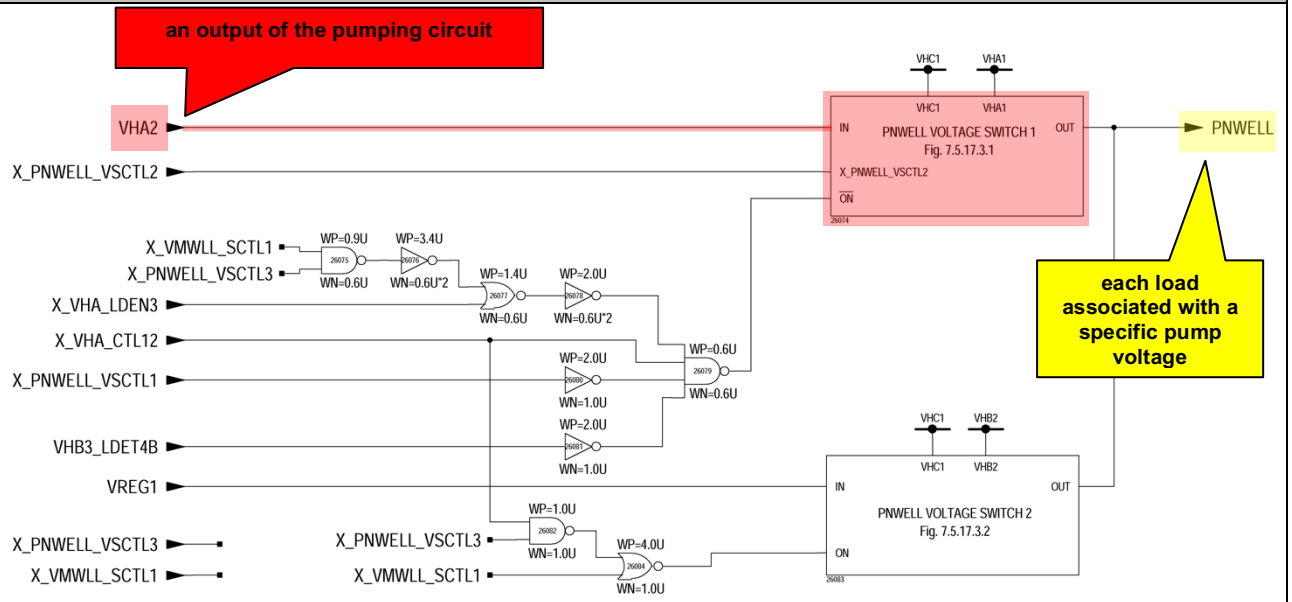
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.8.14 Charge Pump 13

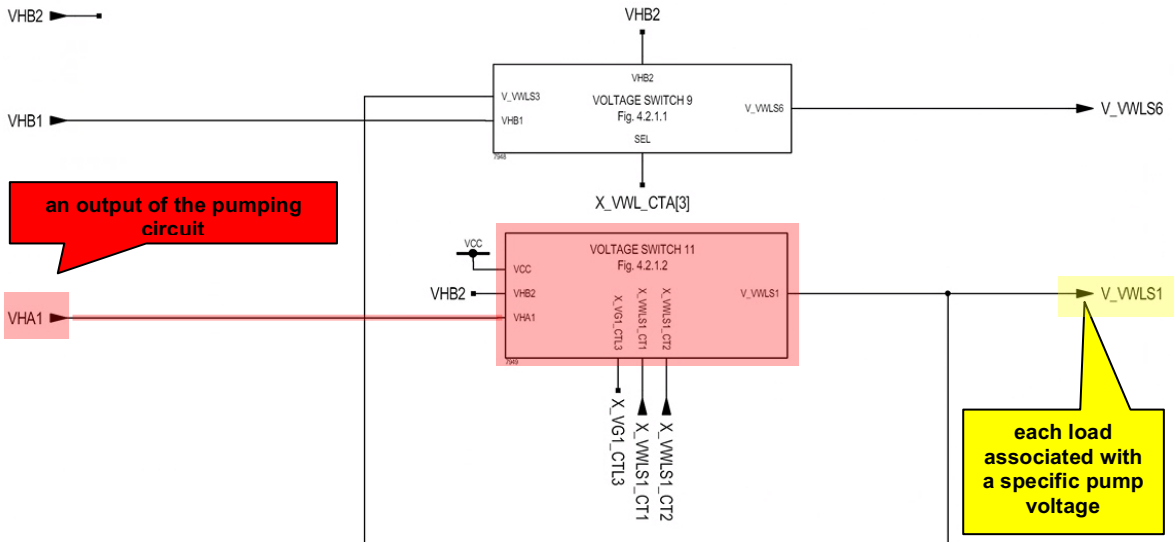
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.8.14 Charge Pump 13
1[b] a plurality of loads selectively coupleable to an output of the pumping circuit,	Each Accused Product includes a plurality of loads selectively coupleable to an output of the pumping circuit, each load associated with a specific pump voltage.

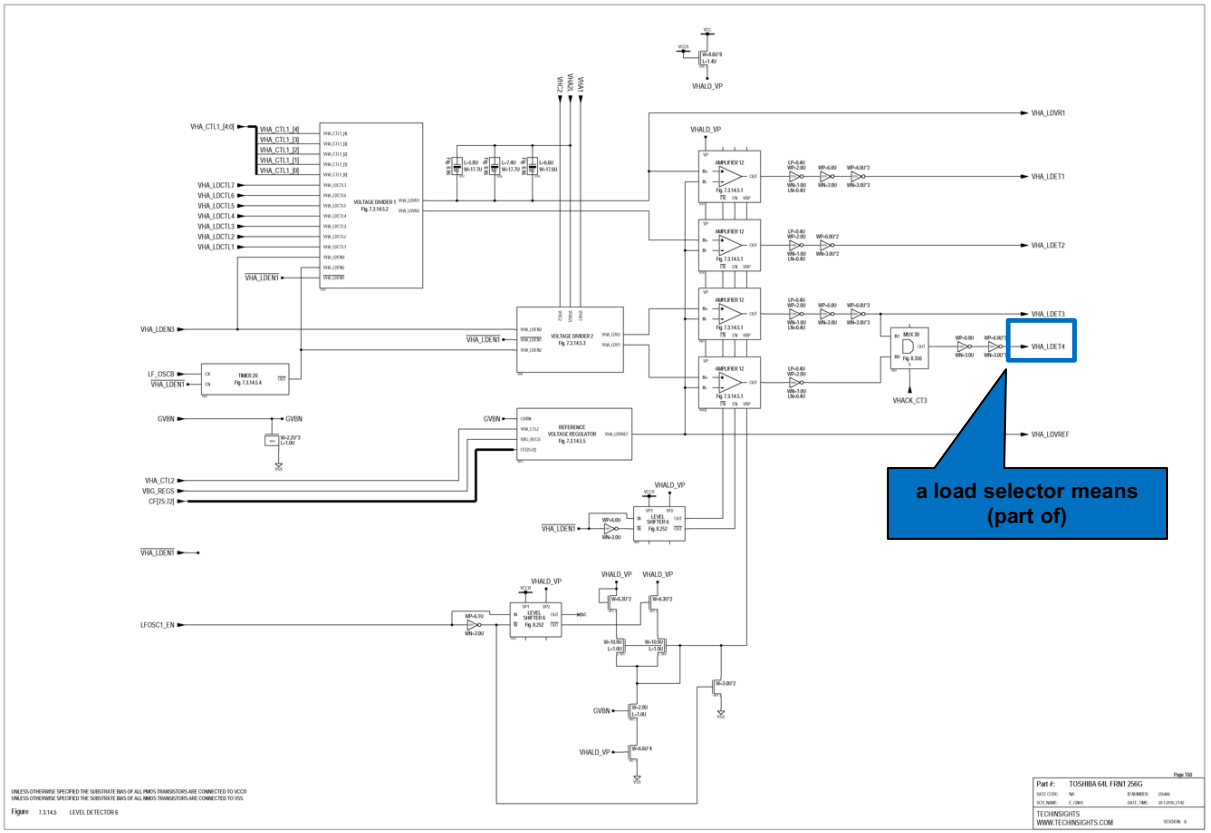
Claim 1	Accused Product
each load associated with a specific pump voltage; and	For example, VHA2 is an output of the pumping circuit. A plurality of loads (contained within Current Sink 2) can be selectively coupled to an output of the pumping circuit (for example VHA2). VHA2 is connected to pumping circuit output VHA1 through Voltage Switches 59 and 60. VHA1 is connected to wordline decoders during read or program operations. Read, program and erase operations require different voltages. Each load is associated with a specific pump voltage to carry out these functions. *See, e.g.*:  Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14 Charge Pump Block 4

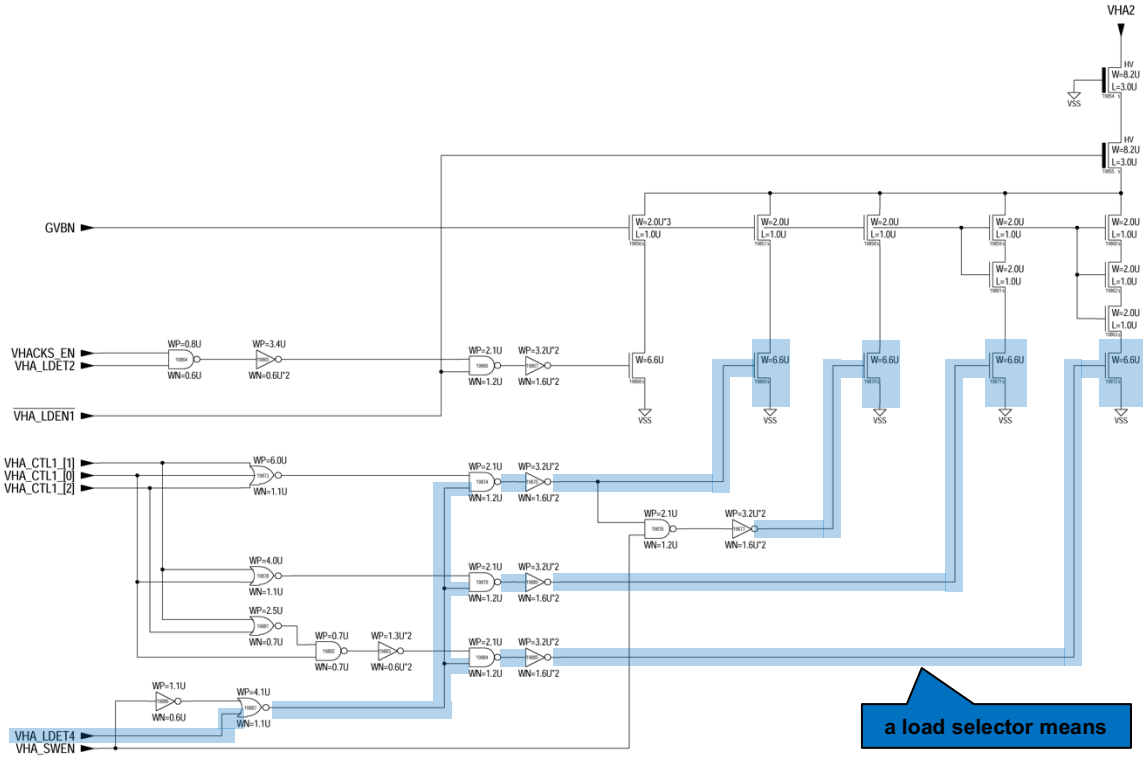
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.8 Charge Pump Block 5

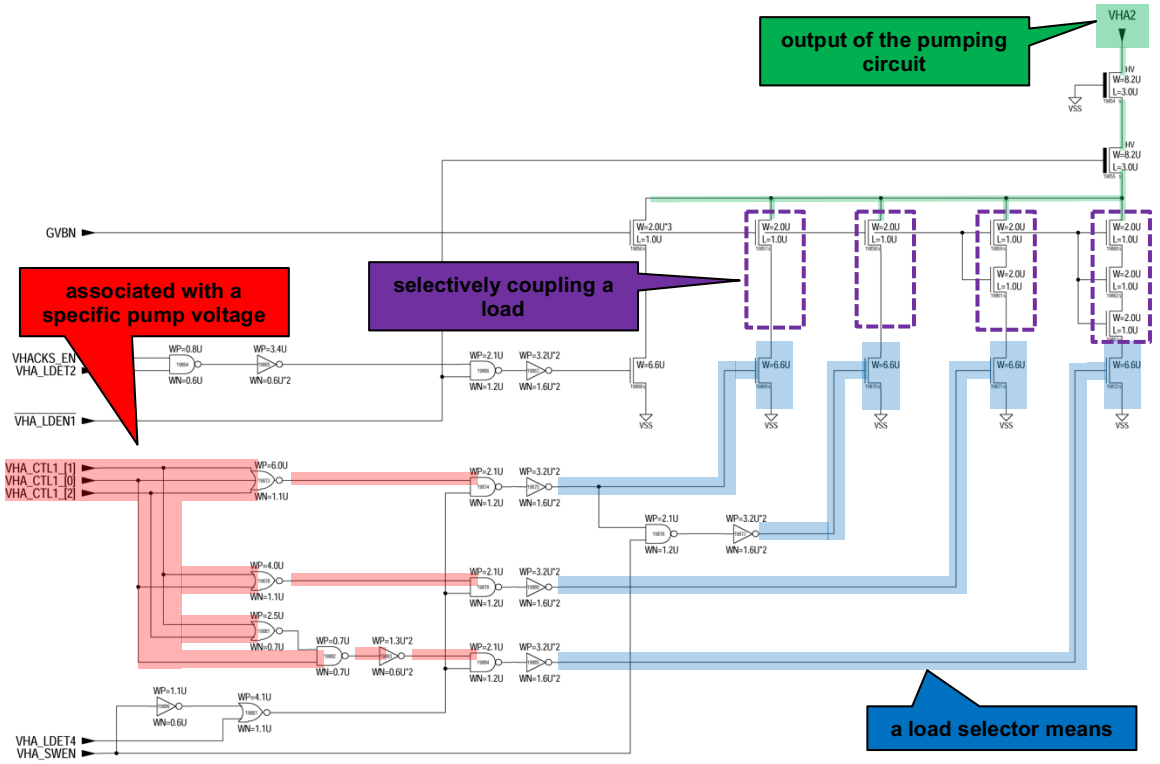
Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.9 Current Sink 2

Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.5.17.3 PNWELL Voltage Selector

Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 4.2.1 Wordline Voltage Switch Block 1
1[c] a load selector means for selectively coupling a load associated with a specific pump voltage to the output of said pumping circuit	Each Accused Product includes a load selector means for selectively coupling a load associated with a specific pump voltage to the output of said pumping circuit. For example, the highlighted transistors below and their respective gate control signals form a load selector means. The output signal VHA_LDET4 from Level Detector 6 forms part of the load selector means. For example, the gate control signals are generated in part by a charge pump control signal (VHA_CTL1). This 3 bit value selectively couples a load associated with a specific pump voltage. *See, e.g.*:

Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.5 Level Detector 6

Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.9 Current Sink 2

Claim 1	Accused Product
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.9 Current Sink 2

Claim 2

Claim 2	Accused Products
2. The charge pump circuit of claim 1, wherein the load selector means includes a	To the extent the preamble is limiting, each Accused Product includes the charge pump circuit of claim 1, wherein the load selector means includes a target output pump selector for shutting down

Claim 2	Accused Products
target output pump selector for shutting down the variable charge pump circuit when the target output pump voltage (Vcfra) is greater than or equal to a reference voltage (Vref).	the variable charge pump circuit when the target output pump voltage (Vcfra) is greater than or equal to a reference voltage (Vref). For example, VHA2 is provided to a level detector which suspends pump clocks when a desired level is reached. VHA2 is scaled by a fixed ratio voltage divider (Voltage Divider 2). It is then compared (using Amplifier 12) to an adjustable reference voltage (generated by Reference Voltage Regulator). A 4-bit digital code CF(75:72) adjusts the output reference voltage by shorting out resistors in a resistor divider, thereby providing programmable pump output voltage levels on VHA1 and VHA2. A comparator (Amplifier 12) compares the scaled VHA2 to the programmable reference voltage. If the scaled VHA2 exceeds the programmable reference voltage, output VHA_LDET3 transitions from 1 to 0 to stop further pumping. *See* evidence and explanation for claim element [1a], *supra*.

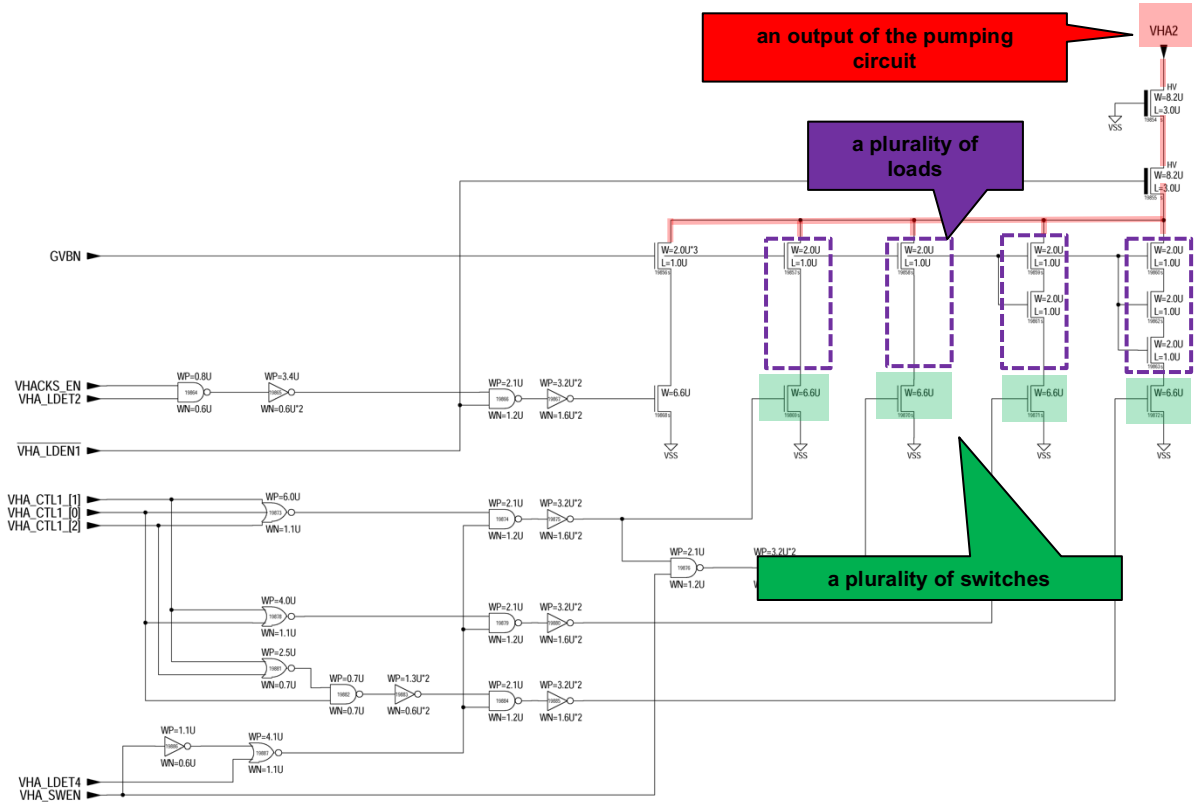
Claim 3

Claim 3	Accused Products
3. The charge pump circuit of claim 2, wherein the load selector means further includes a maximum ripple on the target output selector means for adding a load, whenever a maximum ripple on the target output voltage (Vcfrb) greater than the reference voltage (Vref) then the maximum ripple on the target output selector means adds additional loads until the Vcfrb voltage is	To the extent the preamble is limiting, each Accused Product includes the charge pump circuit of claim 2, wherein the load selector means further includes a maximum ripple on the target output selector means for adding a load, and whenever a maximum ripple on the target output voltage (Vcfrb) greater than the reference voltage (Vref) then the maximum ripple on the target output selector means adds additional loads until the Vcfrb voltage is less than or equal to the reference voltage (Vref). *See* evidence and explanation for claim element [1a] and claim 2, *supra*.

Claim 3	Accused Products
less than or equal to the reference voltage (Vref).	

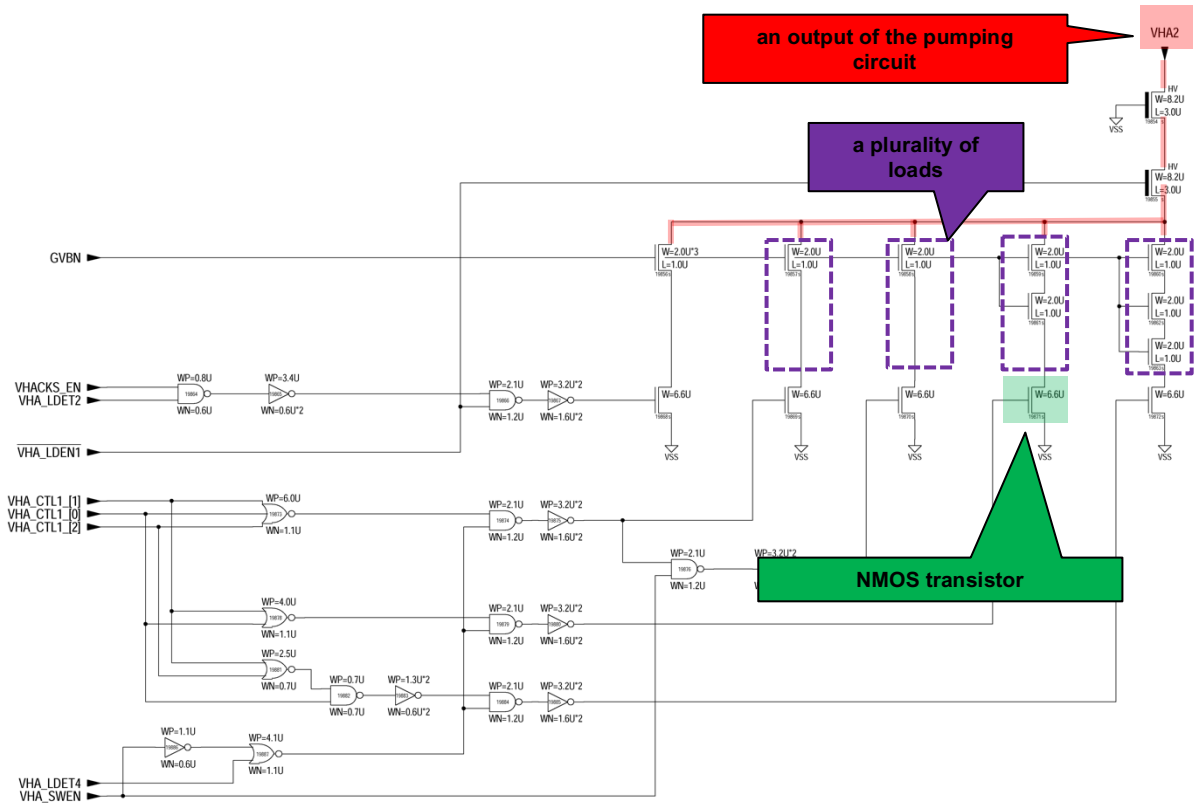
Claim 6

Claim 6	Accused Products
6. The charge pump circuit of claim 1, wherein the load selector means is a plurality of switches, one switch for each of said loads, each switch having a first terminal, a second terminal, and an enable terminal, the switch being coupled in series with each load, the first terminal of the switch being coupled to the output pump and the second terminal of the switch is coupled to each load.	To the extent the preamble is limiting, each Accused Product includes the charge pump circuit of claim 1, wherein the load selector means is a plurality of switches, one switch for each of said loads, each switch having a first terminal, a second terminal, and an enable terminal, the switch being coupled in series with each load, the first terminal of the switch being coupled to the output pump and the second terminal of the switch is coupled to each load. *See, e.g.*:

Claim 6	Accused Products
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.9 Current Sink 2 *See also* claim element [1c] *supra*.

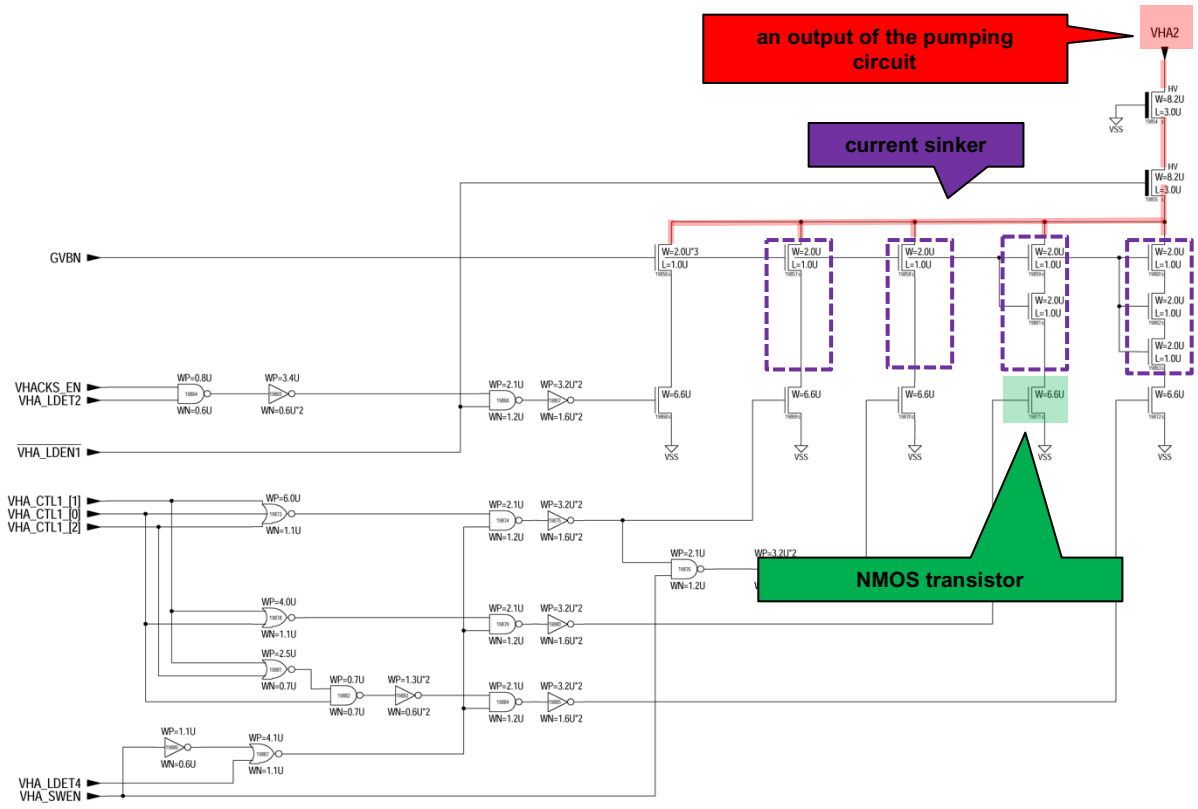
Claim 7

Claim 7	Accused Products
7. The charge pump circuit of claim 1, wherein each load selector means comprises an NMOS transistor having a gate, a drain and a source, the gate of the NMOS load transistor being coupled to an enable signal, the source of the load NMOS load transistor being coupled to an electrical ground, and the drain being coupled to a load.	To the extent the preamble is limiting, each Accused Product includes the charge pump circuit of claim 1, wherein each load selector means comprises an NMOS transistor having a gate, a drain and a source, the gate of the NMOS load transistor being coupled to an enable signal, the source of the load NMOS load transistor being coupled to an electrical ground, and the drain being coupled to a load. *See, e.g.*:

Claim 7	Accused Products
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.9 Current Sink 2 *See also* claim element [1c] *supra*.

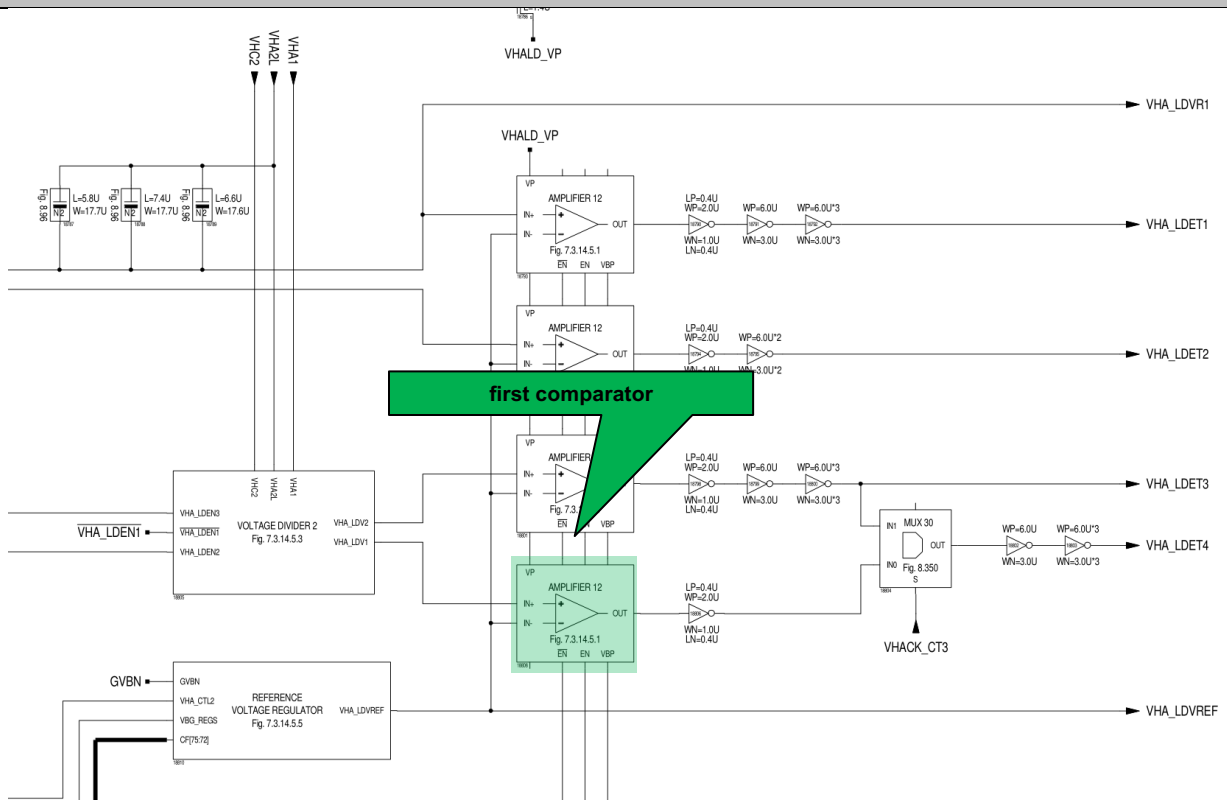
Claim 8

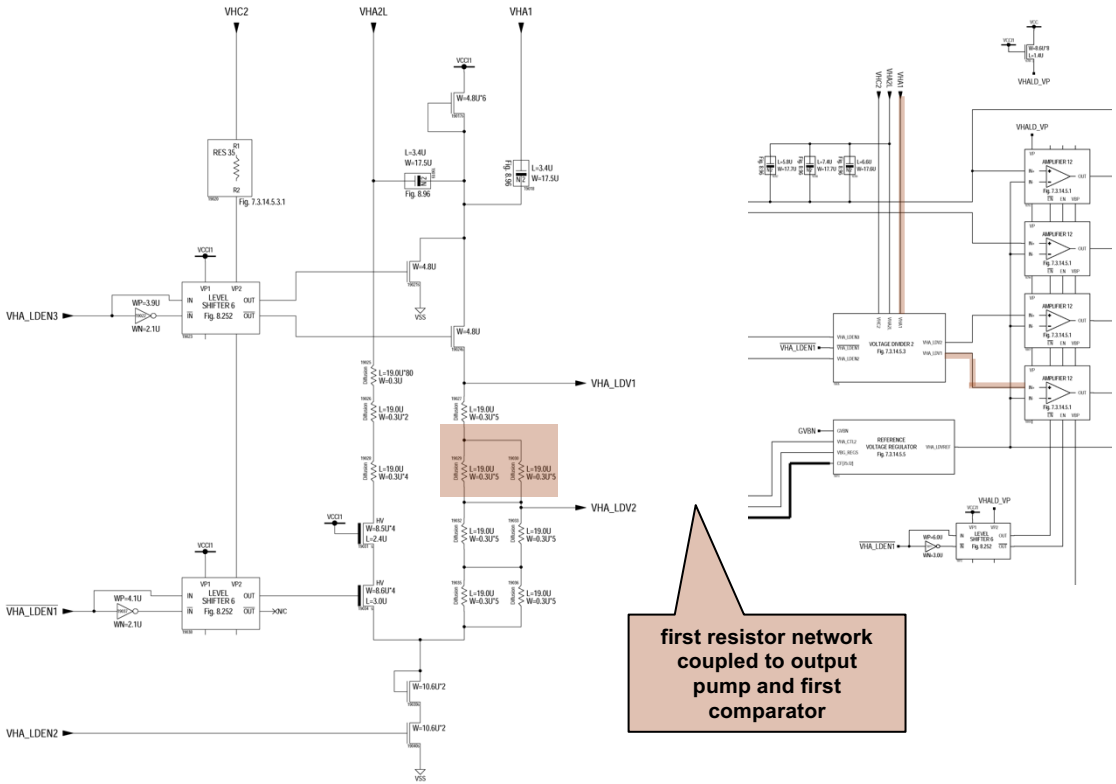
Claim 8	Accused Products
8. The charge pump circuit of claim 7, wherein each load is a capacitor or a current sinker having a first terminal and a second terminal, the first terminal being coupled to the pump voltage and the second terminal being coupled to the drain of the NMOS transistor.	To the extent the preamble is limiting, each Accused Product includes the charge pump circuit of claim 7, wherein each load is a capacitor or a current sinker having a first terminal and a second terminal, the first terminal being coupled to the pump voltage and the second terminal being coupled to the drain of the NMOS transistor. *See, e.g.*:

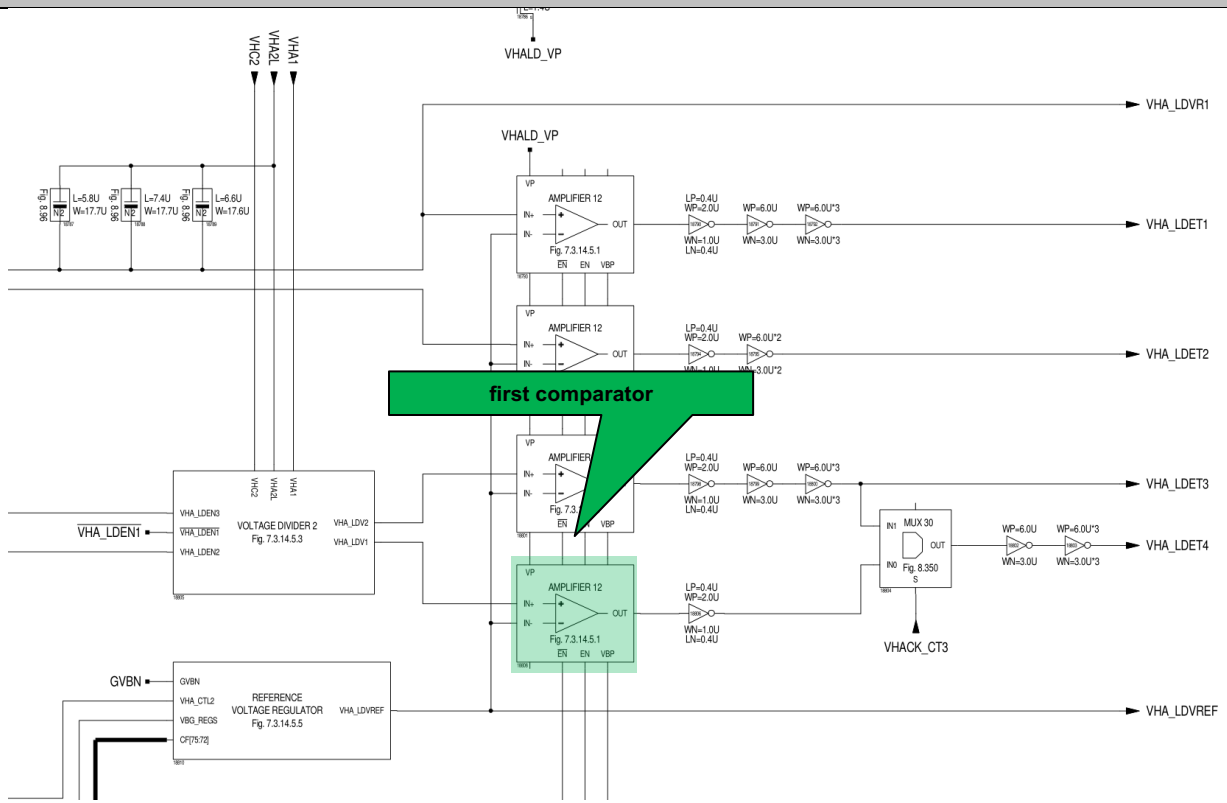
Claim 8	Accused Products
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.9 Current Sink 2 *See also* claim element [1c] *supra*.

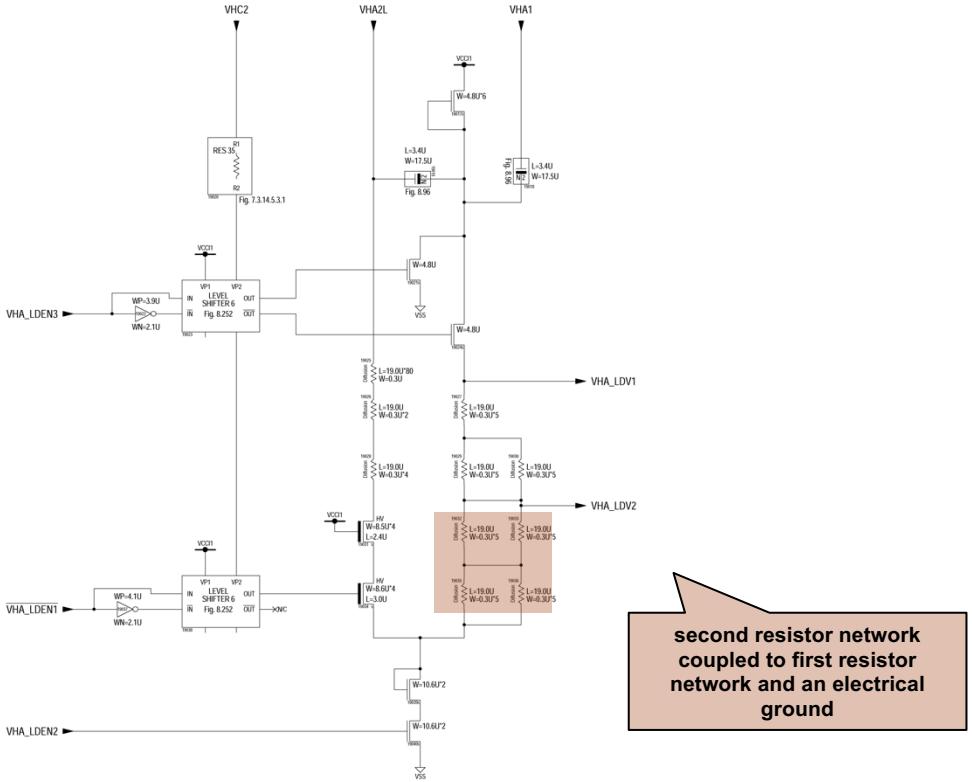
Claim 11

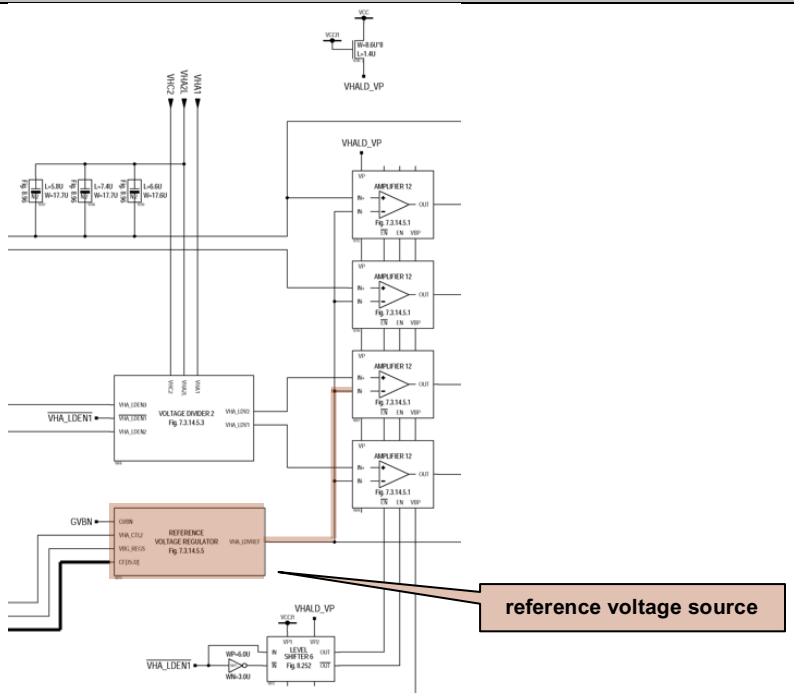
Claim 11	Accused Products
[11pre] 11. The charge pump circuit of claim 2 wherein the target output pump selector comprises:	Each Accused Product includes the charge pump circuit of claim 2. *See supra* claim 2.
[11a] a) a first comparator having two input terminals, an output terminal and a first enable terminal, one of the two input terminals being connected to the reference voltage (Vref);	Each Accused Product includes a first comparator having two input terminals, an output terminal and a first enable terminal, one of the two input terminals being connected to the reference voltage (Vref). *See, e.g.*:

Claim 11	Accused Products
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.5 Level Detector 6
[11b] b) a first resistor network having two terminals, the first terminal being coupled to the output pump, the second terminal being coupled to one of the input terminals of the first comparator;	Each Accused Product includes a first resistor network having two terminals, the first terminal being coupled to the output pump, the second terminal being coupled to one of the input terminals of the first comparator. *See, e.g.*:

Claim 11	Accused Products
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.5.3 Voltage Divider 2; Figure 7.3.14.5 Level Detector 6

Claim 11	Accused Products
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.5 Level Detector 6
[11c] c) a second resistor network having two terminals, the first terminal being coupled to the second terminal of the first resistor network, and the second terminal of the second resistor network being	Each Accused Product includes a second resistor network having two terminals, the first terminal being coupled to the second terminal of the first resistor network, and the second terminal of the second resistor network being coupled to an electrical ground. *See, e.g.*:

Claim 11	Accused Products
coupled to an electrical ground; and	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.5.3 Voltage Divider 2
[11d] d) a reference voltage source (Vref) coupled to one of the input terminals of the first comparator.	Each Accused Product includes a reference voltage source (Vref) coupled to one of the input terminals of the first comparator. *See, e.g.*:

Claim 11	Accused Products
	 Source: TechInsights CircuitVision Analysis of the Sandisk/Toshiba 05138_064G 3D NAND Flash, Figure 7.3.14.5 Level Detector 6